U.S.D.A. FOREST SERVICE ENVIRONMENTAL STATEMENT

BURNING FOR CONTROL OF BIG SAGEBRUSH

Prepared in Accordance with
Section 102(2) (C) of P.L. 91-190

Northern Region

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SUMMARY SHEET

I. Draft ( ) Final (X)

II. Administrative (X) Legislative ( )

III. Description of Action

This Statement discusses prescribed burning as a means of modifying the continuity of the sagebrush ecosystem to improve the range resource for domestic livestock on National Forest land in the Northern Region of the Forest Service, U. S. Department of Agriculture. Fire has been a natural environmental factor in the sagebrush ecosystem and has had but limited effect on the ecosystem. Burning is a natural process which the plant and animal organisms have evolved with and adapted to. For the most part, brush control programs are aimed at restoring the balance of nature rather than upsetting it.

Approximately 1,800 acres per year are proposed for burning during fiscal years 1973-1975 on projects varying in size from 25 to 700 acres. Proposed projects are located in Beaverhead, Gallatin, Jefferson, Madison, and Silver Bow Counties of southwestern Montana on lands administered by the Beaverhead, Deerlodge, and Gallatin National Forests.

IV. Summary of Environmental Impacts and Adverse Environmental Effects

The proposed program will alter existing plant communities from a grassland dominated by sagebrush to a grassland interspersed with sagebrush on specific areas to improve range condition and forage production. Some short-term erosion and water siltation may occur as a result of the temporary removal of protective plant cover. Edaphic factors are affected by increased surface and subsurface temperatures, increased soil moisture, increased activity of soil microflora and microfauna, and a change in nutrient cycling. Air quality will be affected for a brief period at the time of burning. There is an impact on wildlife habitat due to removal of food and cover, and a change in edge effect. Forage production is initially reduced, but recovers within a few years. Scenic quality is degraded for a brief time until vegetation is reestablished and the area assumes the appearance of a natural, open grassland. The anticipated improvement of the socioeconomic status has a stabilizing effect on agricultural based communities.

No plant or animal species, including sagebrush, will be eradicated. A type conversion will modify habitats such that some species are favored, and others suffer, new niches are created, others are destroyed.

V. Alternatives Considered

A. Mechanical Control - Methods to physically destroy sagebrush.

B. Chemical Control

C. Thermal Control

D. Biological Control

E. Intensive Range Management Without Treatment

F. No Action

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VII. Date Draft Statement made available to CEQ and the public: Feb. 2, 1973

Date Final Statement made available to CEQ and the public: APR 19 1973

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CONTENTS

I. DESCRIPTION

A. PURPOSE

Several National Forests in the Forest Service Northern Region have dense sagebrush cover on extensive areas of rangeland. As a consequence, there is an imbalance between forage and nonforage plant species within the sagebrush-grass ecosystem. A program of sagebrush burning proposed for 1973, 1974, and 1975 on selected portions of this rangeland will modify the continuity of dense sagebrush stands and the relative amount of existing species in order that a more balanced, diversified, and desirable variety of plant species may become established. It will also alter the animal components of the ecosystem. Sagebrush control and other rangeland improvement practices, are designed to restore the grass dominance on deteriorated rangelands. When properly applied, burning (followed with proper grazing management which harvests only a specified amount of the forage produced) permits other native herbaceous species to reach optimum development in terms of quality and quantity, and provides a variety of vegetation which can enhance hydrologic conditions, soil stability, wildlife, and other values.

B. ECOLOGICAL SYSTEM

The sagebrush ecosystem is one of the largest range types in the Western United States. Big sagebrush grows over a wide elevational and geographic range extending westward from western Nebraska to the crest of the Cascades in Oregon and Washington and into northeastern California, northward into British Columbia and southward into northern New Mexico (53). It has probably always been an important species in the rangeland ecosystem and a climax dominant on a few sites. Sagebrush has become the dominant plant (25 percent or more crown cover) on millions of acres of sagebrush-grass rangeland in the Western United States with a concurrent decrease in the productivity of other components of the vegetation, particularly grass. Cooper (18) in his studies near Tensleep, Wyoming, concluded that relative amounts of big sagebrush in excess of 10 percent of the total ground cover are indicative of deteriorating range conditions. This study area is not greatly different from much

of the foothill country in the vicinity of Dillon, Whitehall, and Butte, Montana.

Various estimates indicate sagebrush is prominent on 96+ million acres in the 11 Western States (2,19,31,54). An inventory by counties in Montana shows sagebrush as a major species component of the vegetative composition on about 11 million acres (40). In western Montana a sizable acreage represents sagebrush migration into natural grassland. This is particularly true on some well developed soils of medium texture. A considerable amount of this 11 million acres is National Forest rangeland.

Evidence from historical records and studies on pristine or long-protected relict ranges indicates a major part of this sagebrush-grass type was probably a sagebrush savanna with some other shrubs, beneath which thrived a vigorous stand of perennial grasses and forbs. The evidence also indicates that sagebrush is an indigenous component of the natural plant community and that it occupies essentially the same geographic area today as it did in presettlement times (9,20,44,52,68). Dense stands of sagebrush on extensive areas of rangeland today are largely the result of disturbance caused by past human activities, such as heavy uncontrolled grazing, the haphazard use of fire, and the cultivation and abandonment of marginal cropland. These activities coupled with drought upset the natural ecosystem of which sagebrush was a component, and sagebrush was released from its natural biological controls (20,24,54,68). Sagebrush is highly competitive once established on a site because of its ecologically dominant position, and can substantially reduce the amount of herbaceous plants in the understory resulting in reduced grazing capacity of the range. The concern is not with a change in acreage of sagebrush, but with the imbalance of plant biomass within the sagebrush-grass ecosystem.

The sagebrush-grass type consists of many species and subspecies of sagebrush which may be subdivided into two broad categories, big sagebrush and low sagebrush. Within each category are species which

differ greatly in the kinds of environment they occupy, their palatability, their reaction to grazing, and their susceptibility to fire.

Sagebrush control programs are mainly concerned with the big sagebrush group of Artemisia tridentata, Artemisia cana, and Artemisia tripartita. Within this group, Artemisia tridentata is the primary target.

1. Artemisia tridentata (big sagebrush). This species and its subspecies probably occupy a greater acreage in Montana than any of the other species of sagebrush. It grows in association with a large variety of grasses and forbs over a wide range of soil types, elevations, and climatic conditions. The more thrifty and dense stands of this species are found on deep, well drained, loamy soils having upper horizons that consist of granular, friable soil that allows easy circulation of air and water (58,62,67).

Palatability of big sagebrush is generally considered intermediate for wildlife and low for livestock. Literature indicates forage value changes seasonally and varies with sites. Powell (55) cites literature which indicates variability in forage value is influenced partially by the volatile oil content of the leaves. These volatile oils (1) kill rumen microorganisms, (2) decrease appetite and digestibility of forage, and (3) increase plant toxicity and apparent energy values. Cook et al (17) noted that big sagebrush plants of lower stature on poor sites, or on heavily grazed areas, were more readily eaten than robust plants on favorable sites. This could be the result of the volabile oil content as it has been found that the more vigorously a plant grows, the larger the quantity of volatile oil formed.

Big sagebrush increases greatly in density and crown cover under heavy livestock grazing. It is an aggressive plant which takes advantage of any imbalance in the natural plant community. After initial control, followed by proper grazing practices, there are indications that some areas may and that other areas may not require further treatment for control in subsequent years.

2. Artemisia cana (silver sage). This species is usually associated with meadows along valley bottoms and swales. It is moderately palatable for wildlife and sheep, particularly during the winter months. This species tends to sprout vigorously following burning and may soon become more dense on the site than prior to treatment. It does not constitute the same problem as big sagebrush and is seldom the objective of control.

3. Artemisia tripartita (threetip sage). This species occupies rather large areas in some localities, notably the north side of the Centennial Valley of southwestern Montana. It is relatively palatable for wildlife. Like silver sagebrush, it root sprouts following burning, although possibly not as vigorously. In sagebrush burning experiments conducted by Pechanec, Stewart, and Blaisdell (53) on the upper Snake River plains of southeastern Idaho only 6 percent of the threetip sagebrush sprouted.

There is evidence which indicates the presence of a growth inhibitor (or inhibitors) in the leaves of big sagebrush, silver sagebrush, and threetip sagebrush. Wilkie and Reid (73) found that leaf extracts of these species resulted in inhibition of seed germination of Bromus inermis (smooth brome), Sitanion hystrix (squirreltail) and Agropyron trachycaulum (slender wheat). They concluded these species of sagebrush

could influence vegetative distribution patterns since they are capable of reducing germination percentages of at least some grasses.

C. HISTORY AND BACKGROUND

By virtue of its wide distribution and ecological amplitude, big sagebrush has a significant influence on rangeland. Sagebrush-grass rangelands have high potential forage productivity, but are currently producing far below their capability. Literature on range management and control of bushy species highlights reduction of competition from big sagebrush as a basic requirement for effective revegetation on depleted sagebrush-grass ranges, and attests to control as an effective method of rangeland improvement. Research recognizes that benefits include additional livestock forage, more acres of livestock forage available, increased pounds of livestock products, improved watershed conditions and water yields, and improvement of certain wildlife habitat--this latter being somewhat controversial (1,2,8,9,10,19,25,31,44,53,54).

Among the various ecological factors that control the composition of vegetation, fire has been a major component in shaping vegetation patterns for thousands of years (22,49,69). Burning for control of sagebrush has been replaced largely by chemical control in recent years. When properly planned and applied, the use of fire is one of the oldest, most widely adaptable and economical methods, and has proven to be an effective range improvement practice (3,30,54).

The date of burning relative to the growth cycle of a given plant species largely determines the extent to which the species will increase or decrease. Burning is more likely to injure actively growing plants

than dormant ones (2). Burning too late in the spring can injure crowns, rhizomes, and shallow roots of perennial grasses and forbs. Cook (16) indicates fall treatment to be more effective than spring treatment in reducing the percent of original sagebrush cover. Seven years after fall treatment the percent of original cover was 12.4, compared to 35.8 percent 7 years following spring treatment. However, he also found sagebrush reinvasion to be considerably greater on fall treated areas than on spring treated areas. Morris (43) states, "A fast fire is preferred to a slow one for minimum damage to the grasses."

For the proposed program, burning will be done during the period of plant dormancy while carbohydrate reserves are high in the root systems of desirable forage species. Fall burning is to take place after desiccation and prior to sagebrush seed ripening. Spring burning is to be done prior to initial growth of desirable forage species since this growth is made at the expense of carbohydrate reserves (36,54,75). Visual observations of several small spring burned areas in the Bull Mountains north of Whitehall, Montana, indicate timing is critical to avoid severe damage to grasses. A lag of approximately 15 days on two similar sites resulted in grass species being badly damaged while grasses on the early burn were affected only slightly.

Sagebrush control programs utilizing chemical, mechanical, or burning treatments will never eradicate sagebrush as an indigenous component of the natural plant community, nor are they designed to do so. These treatments are not applied to every acre, nor are they 100 percent effective. Lommasson (4) concluded as a result of a 31-year study that big sagebrush will maintain itself as part of the native plant community.

D. ORIGIN OF PROPOSAL

Sagebrush control projects are initiated by the District Forest Ranger in the preparation of the range allotment management plan. Development of the range allotment management plan is preceded by range environmental analysis which inventories the soil and vegetative resource on the grazing allotment.

Guidelines for consideration of a project proposal are: "In the case of sagebrush, rabbitbrush, or a combination, crown cover should exceed 10 to 20 percent on 75 percent of the project area before a control project is contemplated. Large areas of sparse sagebrush-rabbitbrush crown cover should be eliminated from the project." (FSH 2209.23 R1, Nonstructural Range Improvement Handbook, p. 311--2)

The District Ranger develops a detailed project plan using the expertise of specialists in ecology, biology, soils, hydrology, and other sciences as needed. Project proposals are reviewed with Montana Fish and Game Department wildlife biologists.

An environmental impact analysis is part of all project planning. This analysis evaluates environmental impacts that are unique to the specific project, and the cumulative impact of other nearby projects. Specific project plans will be publicized locally, and are, or will be, available from the Forest Supervisor of the National Forest concerned. Participation of local agencies, organizations, and individuals will be sought during the plan preparation period and before the start of work on each project.

Evaluation does not end with the report, but continues over an extended period of several years.

E. PROPOSED ACTION

A program of prescribed burning is proposed for individually selected areas. Burning is a natural process which the plant and animal organisms have evolved with and adapted to. Fire has been a natural environmental factor in the sagebrush ecosystem, and has had but limited effect on the ecosystem.

Brush control programs are carried out on carefully selected areas and are based upon the degree of sagebrush infestation and potential productivity

of the land. Properly carried out, brush control increases the availability of forage for grazing livestock. In addition, on spring ranges this reduction of sagebrush and increase in forbs and grass is beneficial to elk, mule deer, and antelope.

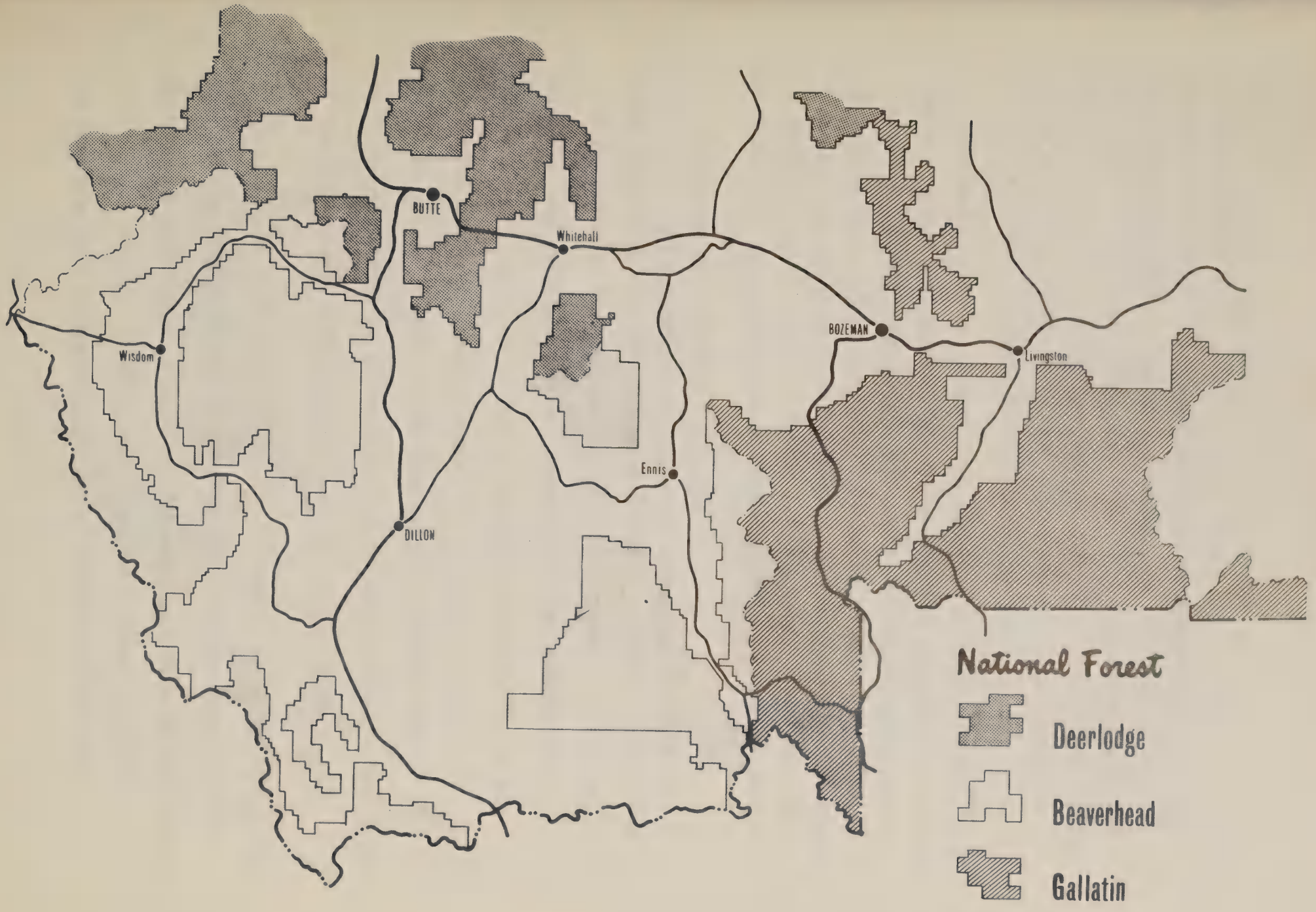
The Forest Service Manual, Section 5153.1, defines prescribed burning as "the skillful application of fire to fuels in a definite area under exacting conditions such as weather, fuel moisture and soil moisture to accomplish certain planned objectives." Biswell (7) and Hall (29) describe prescribed burning as "the use of fire for certain definite reasons where material is burned under planned conditions that will achieve the objective with minimum damage to the environment."

Sagebrush control will be followed by a minimum of 1 full year of total rest with late fall grazing the second year to allow desirable range plants to (1) regain vigor, (2) reseed, and (3) for seedlings to become established. A system of grazing superior to continuous grazing, if not already in effect, will be initiated to increase the quantity and quality of vegetation desirable for livestock forage and afford competition to prevent or reduce sagebrush reinvasion.

F. PROJECT AREA DESCRIPTION

Proposed projects are located in Beaverhead, Gallatin, Jefferson, Madison, and Silver Bow Counties of southwestern Montana (see map). All land is publicly owned and managed by the Beaverhead, Deerlodge, and Gallatin National Forests.

There is an estimated 757,000 acres of sagebrush type on the three National Forests. Approximately 5,475 acres of an estimated 26,100 acres on 24 grazing allotments are proposed for burning during the next 3 years, or about 1,800 acres per year on projects varying in size from 25 to 700 acres. Complete control is not anticipated on each project, particularly the larger projects. Unburned islands and stringers are to be expected. Control is proposed for carefully selected areas, and is based upon the degree of sagebrush infestation and potential site productivity. Also, control of coniferous tree encroachment is often a major consideration in selection of proposed project areas.


BUTTE
Whitehall
Wisdom
BOZEMAN
Livingston
Ennis
DILLON
National Forest
Deerlodge
Beaverhead
Gallatin

Project areas are located in mountainous terrain and range from 5,000 to 7,000 feet in elevation. Slope varies from nearly level to approximately 30 percent. Aspect is variable within and between projects. Annual precipitation averages from 12 to 15 inches at lower elevations to 25 to 30 inches on the higher areas with 75 to 80 percent occurring as snow. Temperature extremes range from -30° to near 90°. Daily summer temperatures range from 70° to 80°. The frost-free period rarely exceeds 45 days and frost can occur at any time of the year.

As described by Morris and Pace (44) sagebrush is associated with rough fescue (Festuca scabrella), Idaho fescue (Festuca idahoensis), bluebunch wheatgrass (Agropyron spicatum), and needle-and-thread (Stipa comata), threadleaf sedge (Carex filifolia), and native bluegrass (Poa sp.), depending upon location, grazing history, or land treatment. Residuals of desirable grass plants are nearly always present in the understory available for increase following control of the sagebrush overstory.

G. SOCIAL AND ENVIRONMENTAL OBJECTIVES

It is generally recognized that there are demands placed on Federal rangelands other than for grazing by domestic livestock. Among these uses are hunting, fishing, camping, and other forms of recreation, wildlife, and water production. Regardless of the intended use, the range environment is subject to great stress whether it be for production of forage, water, recreation, wildlife, esthetics, or some combination of uses. These uses are not seriously competitive with livestock grazing, and should in no way detract from the importance of these rangelands to the livestock industry and society.

The largest source of income in Montana is from livestock production (34). The need for greater production through range improvement methods and enlightened practices of vegetation management is evident in increasing land values, shortage of additional rangeland, economic requirements for more efficient production, and the increasing need for more

livestock products. Intelligent land use thus becomes a prime factor in the continued improvement of living conditions resulting in a strong correlation between land use efficiency and the socioeconomic status of people.

Economists and agricultural experts predict that application of modern techniques can result in the doubling or tripling of present food production levels from current acreages. Crafts (21) aptly states that, "If we will be realistic, we must face up to the fact that besides population control we need now, and will need much more in the future, food from every acre, water from watersheds around the world, fresh unpolluted air, and materials including wood to provide additional housing."

It is expected that:

1. Livestock returns from these rangelands will be increased through production of a greater amount of desirable forage, and improved accessibility to the forage produced.

2. Water yields can be improved through substitution of grasses and forbs which utilize less water than shrubby vegetation.

3. Long-term erosion potential will be reduced through improved ground cover to prevent rapid surface runoff by replacing a species of small basal density with species having greater basal densities.

4. Some wildlife benefits will be realized from the change in the edge effect of an unbroken expanse of a single plant association. In addition, the increased production of succulent forbs and grass that follows burning is beneficial to elk, mule deer, and antelope spring ranges and sage grouse summer ranges.

5. Returns to local, state, and national governments will increase as a result of an increased tax base from the increased annual net return to the livestock industry through increased pounds of livestock products.

Sagebrush control concurrent with proper range management can bring about these benefits in a shorter period of time than proper management alone.

H. ECONOMIC ANALYSIS

Cost information on burning for control of sagebrush is quite limited. Hull (31) reports fire to be the cheapest of the many methods, but gives no cost figures. Pechanec, Stewart, and Blaisdell (53) indicate costs of $0.44 to $0.57 per acre plus at least $0.20 per acre for loss of grazing privileges. Mueggler and Blaisdell (46) report total cost to be about $0.70 per acre, and Pechanec *et al* (54) indicate costs in 1962 of $1 to $4 on tracts of 1,000 acres or more. Costs for a 262-acre burning project in 1969 on the Beaverhead National Forest were $5.74 per acre, and it was estimated a similar project could be accomplished for about $5.10, or less, as a result of the experience gained.

Sampson and Burcham (60) provide the most complete information found on costs for work done in northern California. While the species being treated was different, prevailing conditions are similar for burning sagebrush. Their cost data were limited to the relationship between size of burn and costs per acre for preparation and burning in 1947 and 1948. This information is updated based on the consumers price

index for all goods and services of 53.9 for 1945 as compared to 124.7 for May 1972.[1/] Table 1 lists Sampson's and Burcham's cost data by size of area updated to 1972 costs.

Table 1

Costs of Controlled Burns in Northern California

(Sampson and Burcham 1954)

Size in Acres	1947 - 1948 Cost/A	1972 Cost (124.7 ÷ 53.9 = 2.3135)
40	$3.65	$8.44
80	3.05	7.06
120	2.60	6.02
160	2.15	4.97
200	1.80	4.16
240	1.45	3.35
280	1.20	2.78
320	.95	2.20
360	.80	1.85
400	.65	1.50
440	.60	1.39
480	.65	1.50
520	.65	1.50
560	.80	1.85
600	.95	2.20
640	1.20	2.78

To arrive at an equitable per acre cost for analysis purposes, a weighted cost figure was derived based upon the projects submitted by

[1/] Federal Reserve Bulletin, July 1972

the Forests in their 5-year revegetation report using 1972 costs shown in Table 1. This computation is given in Table 2.

Table 2

Number of Acres	Cost/A	Total Cost
346	$2.20	$ 761.20
760	2.78	2,112.80
600	2.20	1,320.00
150	4.97	745.50
100	7.06	706.00
80	7.06	564.80
100	7.06	706.00
300	2.78	834.00
450	1.39	625.50
200	4.16	832.00
360	1.85	666.00
220	4.16	915.20
100	7.06	706.00
50	8.44	422.00
50	8.44	422.00
25	8.44	211.00
1,000	2.78	2,780.00
400	1.50	600.00
50	8.44	422.00
330	2.20	726.00
5,371		$17,078.00

$17,078.00 ÷ 5,371 Acres = $3.18/A

Table 2

Cost/A	Total Cost
$2.20	
2.18	
2.20	
6.57	
7.06	
7.06	
7.04	
2.73	
1.35	
4.16	
1.85	
4.16	
7.05	
6.44	
8.44	
8.34	
2.18	
1.50	

Studies by agricultural experts, economists, researchers, and comments from ranchers attest to the value of vegetative modification as a range improvement practice (2,8,9,11,33,51,54,59).

Data from Pechanec, Stewart, and Blaisdell (53) indicate that within 4 years after burning perennial herbaceous production increased 90 percent and after 15 years was still 33 percent greater than on an unburned sagebrush range. These changes in vegetation resulted in an 85 percent increase in livestock grazing capacity within 4 years which was still 60 percent higher after 15 years. Although total yield of forage was higher, the primary reason for increased livestock grazing capacity was the increase from 55 to 80 percent in availability.

Blaisdell (9) found grass and forb production 20 percent higher on one burned area and 49 percent higher on a second study area with available herbage for livestock 72 and 96 percent higher. Studies by Mueggler and Blaisdell (46) show total air dry production of desirable and moderately desirable livestock forage species to be 621 pounds 3 years following burning as compared to 385 pounds on untreated range, a 61 percent increase. Availability increased from 75 percent to 98 percent.

Analysis of air dry forage production for six areas on the Beaverhead National Forest in the sagebrush-grass type shows annual production of grass to average 602 pounds per acre and forbs to average 442 pounds per acre (61). These can be considered typical average yields for sagebrush-grass range in southwestern Montana. Based on the studies of Pechanec, Stewart, and Blaisdell (53) and Mueggler and Blaisdell (46) only 55 to 75 percent of the forage under sagebrush is available.

Assuming 65-percent availability to be reasonable, usable forage on the average sagebrush range would be 391 pounds per acre of grass and 287 pounds per acre of forbs, a total of 678 pounds per acre.[2/]

Research cited above indicates that perennial forage production increases an average of 55 percent following burning, and availability increases by approximately 25 percent. Using this information it seems reasonable to expect production of 933 pounds per acre for grass and 685 pounds per acre for forbs with deferment of 2 to 3 years following burning.[3/] Assuming 90 percent availability to be reasonable, usable forage would then be 840 pounds per acre in grass and 616 pounds per acre in forbs, a total of 1,456 pounds per acre.[4/]

Assuming proper use of 45 percent on grass and 20 percent on forbs prior to and following treatment, forage available to livestock would be 233 pounds per acre on unburned range and 501 pounds per acre following burning and deferment.

The above information is presented in Table 3.

Table 3

	Unburned - lbs/acre			Burned - lbs/acre		
	Produced	65% Available	P.U. 45% Grass - 20% Forbs	Produced	90% Available	P.U. 45% Grass - 20% Forbs
Grass	602	391	176	933	840	378
Forbs	442	287	57	685	616	123
Total	1,044	678	233	1,618	1,456	501

2/602 lbs/A. X .65 and 442 lbs/A. X .65
3/602 lbs/A. X 1.55 and 442 lbs/A. X 1.55
4/933 lbs/A. X .90 and 685 lbs/A. X .90

As shown in Table 4, returns from treatment would be 574 pounds (55%) increase in total perennial forage production per acre, 778 pounds (115%) increase in total forage available, 268 pounds (115%) increase in usable forage for livestock, and 306 pounds (38%) increase left as ground cover for watershed protection and wildlife.

Table 4

	Pounds Forage per Acre			Percent Increase
	Unburned	Burned	Difference	
Total produced	1,044	1,618	+574	55
Total available	678	1,456	+778	115
Total usable	233	501	+268	115
Total - Other (Prod. minus usable)	811	1,117	+306	38

It should be noted in Table 4 that under proper grazing management, while reducing the percentage of material left on the ground from 78 percent on the unburned to 69 percent on burned areas, total herbage available for watershed protection and wildlife is increased. In this example, herbage available for watershed and wildlife exceeds total production on the unburned area. There will be variances between areas and for individual years, but the general relationship should hold true.

1. Economic Returns. To arrive at dollar values, the increased forage production available for livestock use is converted to 0.37 AUM's per acre (268 lbs ÷ 720 lbs need per AUM). This increase in production is expected to be available for at least 15 years (53), and under a system of proper grazing management a project life of 20+ years can

be expected. Toward the end of this life expectancy, production may taper off as a balance between sagebrush and perennial vegetation is reached. A 15 to 20 year expectancy is used only for the purpose of analysis. It is not intended to imply that herbaceous production will drop to pretreatment levels.

The benefit is calculated using $3.97 as the average fair market value in the Western States for one animal unit month of forage (AUM), and the Forest Service 1966 base grazing fee of $1.23 per AUM. The $3.97 is derived from an index of private land grazing lease rates on page 44 of the August 1971 issue of Farm Real Estate Development compiled by the USDA Economic Research Service.

The annual economic return from increased usable forage is derived by multiplying the $3.97 fair market value of one AUM and the $1.23 base grazing fee by the 0.37 AUM per acre increase. This comes to $1.47 and $0.46, respectively, per acre.

a. Current Value of 10-Year Income Stream Based on 7-1/2 Percent Rate for Moderate Risk Investment. The present value of $1 annual income extending over a period of 10 years, payable at the beginning of the year, at 7-1/2 percent compound interest amounts to $7.38. This $7.38 is not reduced since areas will be burned during the rest period of the intensive management system and there is no lost income the first year.

Multiplying the annual economic return of $1.47 per acre by $7.38 (the present worth of expected future incomes) gives an expected economic benefit of $10.85 per acre treated. Multiplying the expected

return to the Government of $0.46 per acre by $7.38 gives a benefit of $3.39 per acre treated.

b. Current Value of 15-Year Income Stream Based on 7-1/2 Percent Rate for Moderate Risk Investment. The present value of $1 annual income extending over a period of 15 years under the same conditions as (a), above, amounts to $9.49.

Multiplying the annual economic return of $1.47 per acre times $9.49 (the present worth of expected future incomes) gives an expected economic benefit of $13.95 per acre treated. Multiplying the expected return to the Government of $0.46 per acre times $9.49 gives a benefit of $4.36 per acre treated.

c. Current Value of 20-Year Income Stream Based on 7-1/2 Percent Rate for Moderate Risk Investment. The present value of $1 annual income extending over a period of 20 years under the same conditions as (a), above, is $10.96.

Multiplying the annual economic return of $1.47 per acre by $10.96 gives an expected economic benefit of $16.11 per acre treated. Multiplying the expected return to the Government of $0.46 per acre by $10.96 gives a benefit of $5.04 per acre treated.

2. Benefit-Cost Ratio

a. Ten-Year Term. The calculated benefit-cost ratio to the national economy over a 10-year period would be $10.85 ÷ $3.18 = 3.38. The benefit-cost ratio in monetary returns to the Government

would be $3.39 ÷ $3.18 = 1.06. That is, for every $1 expended, the economy would benefit in the amount of $3.38 per acre and the return to the Government would be $1.06 per acre from increased grass production available for use as forage.

b. Fifteen-Year Term. The calculated benefit-cost ratio to the national economy over a 15-year period would be $13.95 ÷ $3.18 = 4.39. The benefit-cost ratio in monetary returns to the Government would be $4.36 ÷ $3.18 = 1.37. That is, for every $1 expended, the economy would benefit in the amount of $4.39 per acre and the return to the Government would be $1.37 per acre from increased grass production available for use as forage.

c. Twenty-Year Term. The calculated benefit-cost ratio to the national economy over a 20-year period would be $16.11 ÷ $3.18 = 5.07. The benefit-cost ratio in monetary returns to the Government would be $5.04 ÷ $3.18 = 1.58. For every $1 expended, the economy would benefit in the amount of $5.07 per acre and the return to the Government would be $1.58 per acre.

Comparison of the current value and the benefit-cost ratio for the 10-year, 15-year, and 20-year terms are shown in Table 5.

Table 5

Project Life Expectancy	Total Present Value Per Acre Treated		Benefit-Cost Ratio	
	National Economy	Government Return	National Economy	Government Return
10 years	$10.85	$3.39	3.38	1.06
15 years	13.95	4.36	4.39	1.39
20 years	16.11	5.04	5.07	1.58

3. Internal Rate of Return. Additional livestock can be run on a range without much increase in fixed costs in many cases. Increasing the capacity can be accomplished by using the resource more efficiently. The investment in range improvement made at the present time results in returns over a period of time. The income stream expected over this period of time has to be put in terms of the present. The process by which the flow of future returns are brought to the present is called discounting. Nielson (51) discusses a method of determining the discount rate which makes the discounted returns equal to the cost of obtaining the income stream. The discount rate which makes these two sums equal is known as the "internal rate of return." The decision to invest or not invest is based on the magnitude of the internal rate of return.

Considering this from another angle, if (I) dollars invested in a range improvement program are put in savings today, what interest rate would have to be paid to make it equal the value of (R) dollars income a year for a determined period of time. Interest tables showing the present value of $1 received annually for a given number of years have been constructed to determine these interest rates. The internal rate of return is computed as follows:

$$I = R\left[\frac{1 - (1 + i)^{-n}}{i}\right]$$ where: I = Initial Rate of Investment

R = Net Additional Annual Return

$$\text{DF (Discounting Factor)} = \left[\frac{1 - (1 + i)^{-n}}{i}\right]$$

The formula can now be stated as: $I = R \times DF$.

$$\text{accounting factor} = \left[\frac{1 - \quad}{} \right.$$

To develop (I) and (R) for the formula, figures in Table 3 are used. These are 233 pounds per acre for untreated range and 501 pounds per acre for treated range. Dividing these pounds per acre by 720 pounds (requirement per AUM) gives 0.32 AUM's and 0.70 AUM's per acre, respectively. Using $3.97, the average commercial value per AUM, and $1.23, the 1966 Forest Service base grazing fee, the internal rate of return for the annual national economic benefit and annual Government return is calculated. Total acres to be treated were rounded to 5,400.

a. Annual Economic Benefit

(1) Initial investment (5,400 acres x $3.18/A)(I)	$17,172
(2) Pretreatment return (5,400 x 0.32 x $3.97)	6,860
(3) Post-treatment return (5,400 x 0.70 x $3.97)	15,007
(4) Net additional economic benefit (3 minus 2)(R)	8,147

$17,172 = 8,147 x (DF)

DF = $17,172 ÷ $8,147

DF = 2.108

The interest rate corresponding to 2.108 is approximately 46-1/2 percent for the 10-year period and 47-1/2 percent for both the 15- and 20-year periods.

b. Annual Government Monetary Benefit

(1) Initial investment (5,400 acres x $3.21/A)	$17,172
(2) Pretreatment return (5,400 x 0.32 x $1.23)	2,125
(3) Post-treatment return (5,400 x 0.70 x $1.23)	4,649
(4) Net additional Government return (3 minus 2)	2,524

$17,172 = $2,524 x (DF)

DF = $17,172 ÷ $2,524

DF = 6.804

The interest rate corresponding to 6.804 is approximately 7-5/8 percent for the 10-year period, 12 percent for the 15-year period, and 13-1/2 percent for the 20-year period.

The above indicates that an interest rate of 46-1/2 percent would be returned on the investment of $17,172 to equal the value of $8,147 per year for a 10-year period ($81,470), and 47-1/2 percent would return $8,147 per year for a 15-year period ($122,205), and for a 20-year period ($162,940) as annual national economic benefits. An interest rate of 7-5/8 percent on the investment would return $2,524 per year over a 10-year period ($25,240), 12 percent would return $2,524 per year over a 15-year period ($37,860), and 13-1/2 percent would return $2,524 per year over a 20-year period ($50,480) as annual returns to the Government. The rate of return is over and above the liquidation of the investment costs.

I. SUBSEQUENT MANAGEMENT

Burned areas are rested from grazing by domestic livestock use during the grazing season following burning and for the growing season the following year. If necessary, some areas may be rested 2 years and through the growing season the third year, depending upon recovery. This can be accommodated with a minor adjustment in the grazing prescription for an allotment without damage to the allotment because of the flexibility in an intensive management system.

When grazing is resumed, management is under a system of deferred rotation, rest rotation, or rotation. Controls to implement these

grazing systems are already installed, or will be installed before livestock return to the area. The key to the effectiveness of quality management is the positive control capability and schedule for carrying out the grazing treatments stated in the selected grazing formula. This formula is designed to provide quality livestock management in each specific forest-range ecosystem. Inspections will be made for range readiness, livestock controls, proper use, management problems, key wildlife areas, and adequacy of the grazing formula to insure that management objectives are carried out.

J. INFORM AND INVOLVE PUBLIC

An I&I plan on the sagebrush burning program will be developed by the National Forests for which the program is proposed. Every opportunity should be taken to keep the public informed. The information should include, but not be limited to, the following:

1. Where and when burning will be done.
2. The objectives of the burning program.
3. How prescribed sagebrush burning fits into ecologically sound resource management.
4. What results are expected--good and bad.
5. The precautions which will be taken to reduce adverse impacts.
6. Why burning is being employed instead of some other method of treatment.

II. ENVIRONMENTAL IMPACTS

Burning for sagebrush control will alter existing plant communities and ecosystems. Several perennial grass and forb species are damaged by fire and are slow to recover. Through removal of protective plant cover, some short-term erosion and water siltation can be expected before new plant cover becomes established. The change in food, cover, and edge effect for wildlife is an impact upon the habitat. Air quality is affected for short periods of time. Forage production is initially reduced, but is increased within a few years. Temporary microclimatic changes which can be expected are: increased solar radiation and modification of spectral composition of light received, higher air and soil temperatures, increased air movement, and decreased relative humidity and interception of precipitation. These can lead to changes in edaphic factors such as increased soil temperature at surface and subsurface levels, increased soil moisture, and increased activity of soil microflora and microfauna.

No long-term effect on animal or plant organisms is anticipated, nor is any species expected to be eradicated. A type conversion will modify habitats such that some species are favored, and others suffer; new niches are created, others are destroyed.

Sagebrush control on public land can alter land use patterns on private lands and ranch management operations. This could effect the socio-economic status of agricultural based individuals, communities, and industry. In addition, there is an effect upon people using public, and possibly private, lands for hunting, fishing, camping, and other forms of recreation with regard to individual social and economic values.

Detailed environmental impacts and planned measures to minimize those that are adverse are discussed in Sections III and IV of this report.

III. FAVORABLE ENVIRONMENTAL EFFECTS

A. AIR

There are no known direct favorable effects on air quality. Smoke becomes part of the gaseous and particulate loading of the atmosphere. Particulates are cleansed from the air when they become nuclei for condensing and freezing water, and fall with the rain or snow (5). There was no research found that would indicate smoke particulates are necessary as nuclei or influence precipitation patterns; however, for eons nuclei in the form of dust, salt from the oceans, and smoke from forest fires helped provide the weather essential to man's existence.

B. SOIL

Various studies on big sagebrush support the widely used criteria that tall and dense stands usually indicate moderately deep, fertile, productive soils and favorable soil moisture conducive to high grass production potential on the site (54,58,62,67).

A dense sagebrush stand may have a canopy cover of 60 percent, but only a basal density of 3 percent which affords little potential to prevent rapid runoff (1). Replacing the stand with a ground cover of grass and forbs having a greater basal density (1) reduces the erosion potential from overland flow and high intensity storms, (2) increases vegetation and litter cover thus aiding in absorption of precipitation, and (3) improves soil structure due to increased amount and variety of roots and organic matter content. Also, burning the vegetative cover temporarily increases soil fertility and available nutrients, primarily nitrogen, phosphorus, and sulphur, available for plant growth (9,23,71).

C. WATER

Precipitation received on a watershed is handled in several ways, it evaporates from soil and plant surfaces, is extracted from the soil by plant transpiration, runs off the soil surface, or infiltrates into the soil.

It is generally recognized that sagebrush is a wasteful and rapid user of available soil moisture. Alley (76) reports that in Wyoming big sagebrush transpires in a 4-month period enough water to equal 3½ inches of precipitation. He states that: "Where watersheds have been sprayed and a high percentage of the big sagebrush killed, the underground water sources such as springs, that usually dry up in the summer, run water all year long." The root system not only has highly developed laterals for shallow absorption, but also a deep taproot to reach deeply stored soil moisture (10). Sagebrush plants may transpire at any time of the year with transpiration rate limited only by available soil moisture (28). Biswell (8) reports that: "The greatest opportunity for increasing water yield from rangeland lies in reducing shrubs and trees and substituting grasses and forbs.

Evidence from several studies indicates sagebrush removal increases soil moisture. Since shallow-rooted species utilize soil moisture mainly from the upper 2 feet of soil and transpire less water, less precipitation is needed to fill the soil to storage capacity. Moisture which is not utilized moves to underground storage by deep percolation, moves into springs or streams through seepage or lateral movement, or is retained as soil moisture. Thus, water yields from the watershed may be increased (8,25,64). Conversely, Hutchinson (32) found significantly more snow accumulated in sagebrush areas than on comparable grass-covered areas which could result in earlier peak flows and incomplete soil moisture recharge.

Increased water yield from any form of vegetative manipulation is directly related to the average annual precipitation the area receives. Benefits that increased water yields can provide are:

1. More water for livestock and wildlife through increased annual yields or flows extended into dry summer periods from springs.

2. Increased stream flows may improve overall quality of fisheries.

3. More water available for downstream uses.

4. Water quality should improve with establishment of high density ground cover that would tend to reduce surface runoff and decrease sediment loads.

5. Increased soil moisture which will delay plant dessication.

D. VEGETATION

The effects on vegetation are favorable or unfavorable depending on how they are viewed in relation to the uses made of the vegetation, or the uses or actions that are restricted by the vegetation. Brush control and other rangeland improvement practices are designed to restore the grass dominance on deteriorated rangeland.

In dense stands, sagebrush is definitely undesirable when considering livestock management, and to a certain extent for wildlife, hydrology, and watershed values. Cattle hardly use sagebrush at all and sheep graze it only lightly as winter forage during cold periods, it restricts livestock and to some extent big game movement, and uses moisture and nutrients that should be producing good forage and ground cover. Grasses and forbs cannot successfully compete with established sagebrush plants for sunlight and soil moisture (10,19,31,54,55). Frischknecht (26) reports depressed yields of grass around big sagebrush plants are associated with the highly developed lateral sagebrush roots in the grassroot zone which influences grass yields markedly to the 3-foot radius from large sagebrush plants.

Also, there is evidence of growth inhibitors in the leaves of sagebrush. Wilkie and Reid (73) found that leaf extracts of Artemisia cana, A. nova, A. tridentata, and A. tripartita resulted in inhibition of seed germination of slender wheatgrass, smooth brome, and squirreltail. These results show the four species of sagebrush are capable of reducing the germination percentages of at least some species of grasses and thus influencing the distribution patterns.

Studies have found that rhizomatous species of grass and forbs are lightly affected and that damage to most desirable forage species is fairly low when burned during plant dormancy while the root carbohydrate level of bunchgrasses is high (9,54,75). Mueggler and Blaisdell (46) report burning appeared to benefit many species of Agropyron, Calomogrostis, Stipa, Astragalus, Lupinus, Erigeron, Chysothamnus, and Tetradymia.

Early in the spring following burning, much of the ground may be occupied by annuals. As the season progresses, new shoots of rhizomatous grasses and forbs appear and tuft-forming species begin to stool out, but very few perennial seedlings appear. During the second year, perennial grasses and forbs continue to increase in number and take up much of the moisture formerly used by sagebrush, vigor is high, and flower stalks are usually abundant. The abundance of flower stalks can give an erroneous impression that the range is better this second year than in any following year. Many grasses and forbs have recovered sufficiently within 3 years to make full use of the soil moisture, and are producing considerably more herbage.

The amount and type of favorable effects vary greatly depending on conditions prior to treatment and capability of the site. Potential benefits are:

1. Long-term favorable effect on production of herbaceous vegetation.

2. Increase in number of desirable forage species, thus improved forage quality.

3. More diversity of plant species which provides a better buffer against insect and disease, and a diversified habitat for a greater number of animal and bird species.

E. WILDLIFE

Game ranges are not static, but provide game animals with a constantly changing diet due to the nutrient differences in plants during seasonal progression. The succulent forage available during late spring and early summer provides nutrients needed for growth, fawning, lactation, antler development and body tone. As plant growth matures in the late summer and early fall, fat and carbohydrates increase and the diet changes from a growing ration to a fattening ration. During winter, plants are dormant and supply only a maintenance ration. A large number of palatable forage species on a game range will provide a more balanced diet and give animals an opportunity to select the more nutritious species and plant parts.

Any species of wildlife is dependent on three basic essentials: food, cover, and water. The edge effect, where two plant associations meet, generally produces the best habitat. Unbroken expanses of a single plant association seldom create ideal habitat for wildlife be it virgin forest, heavy brushland, or grassland. Optimum wildlife habitat is usually composed of a large diversity of plant species growing as browse clumps interspersed through grass-forb openings providing maximum edge. From this, it logically follows that control programs which are applied to a limited area, rather than a large block because of either terrain or vegetation, can possibly benefit wildlife. When range improvement is

confined to the areas on which it is most economical both game and livestock can be benefited (13).

There is considerable information to indicate that the various species of sagebrush are important to many different kinds of wildlife. Studies by Cole (14) and Bayless (4) indicate big sagebrush to be the most important shrub in the winter diet of pronghorn antelope. Mule deer may depend heavily on sagebrush during winter months, but they require other food species along with sage (63). Elk utilize sage during the winter months; however, they generally prefer grass and forbs, and do not depend heavily on sagebrush except during heavy snow when other species are not available (66). Mussehl (48) reviewed literature on sage grouse and concluded that: "All studies to date have clearly shown sage grouse to be tightly bound to a sagebrush environment."

The following are potential favorable effects:

1. Elk. Elk can benefit from the burning program as a result of the increase in grass and forbs. There are a number of elk food habit investigations dealing with elk herds east of the Continental Divide in Montana. These investigations report grass constitutes the primary forage beginning in September and continuing well into May with winter range consisting primarily of the fescue-wheatgrass zone. Feeding habits shifted heavily to forbs in late May and early June which carried through the summer to early September (66,79,81,83,84). Also, Wilbert (72) reported an increase in elk use during the spring on two areas where sagebrush was controlled which relieved pressure on other critical areas.

2. Mule deer. The value of sagebrush can be overrated. Literature indicates the forage value of sagebrush changes seasonally and varies among sites. Powell (55) cites literature which indicates variability in forage value is influenced partially by the volatile oil content of the leaves because these volatile oils kill rumen microorganisms, decrease appetite, decrease digestibility of forage, and increase plant toxicity and apparent energy levels. He reports that in general the more vigorously

the plant grows, the larger the quantity of volatile oil formed. This correlates with Nagy et al (50) who found essential oils of sagebrush inhibited cultured deer rumen microorganisms, and concluded cellulose digestion will be slowed slightly if the diet contains 15 to 30 percent sagebrush.

Where bitterbrush (which some studies have found to be slow to recover), rabbitbrush, gray horsebrush, silver sage, and other root sprouting shrubs occur, burning can increase production of these more palatable shrubs which can contribute substantially to habitat improvement. Pockets of silver sage in key areas may be planned for burning because of its re-sprouting characteristic to improve winter range. Wilkins (74) found that use of sagebrush increased as availability of more desirable browse declines, and South (65) found rabbitbrush and gray horsebrush were used extensively during the winter. In addition, it is reported that lack of succulent perennial grasses and forbs which make up the greater part of the early spring diet creates a serious forage deficiency. The period of 3 to 6 weeks from first green growth until new growth is plentiful is often extremely critical, particularly for pregnant does. Inadequate nutrition at this time considerably influences prenatal development and subsequent survival of fawns (82). These three reports found that succulent perennial grasses and forbs, which are not eliminated by burning and are the first to reappear, become the most important forage class for the summer period.

3. Antelope. Antelope use the sagebrush-grassland during winter and through the summer with use shifting to grasslands in late summer (4). If given a choice, antelope tend to avoid tall, dense sagebrush. It has been suggested that antelope prefer range where they have freedom to run, and are able to observe predators. Burning may benefit summer habitat on some areas, although the projects are mainly outside of summer antelope range, and they migrate from the vicinity of project areas to winter.

4. Sage grouse. As stated earlier, sage grouse are closely associated with a sagebrush environment. They are largely dependent on sagebrush

for nesting and escape cover, as well as for food (42,48,57). Strutting activities take place on relatively open areas surrounded by sagebrush where habitat requirements are fulfilled within 1/2 to 1 mile cruising radius. Nesting requirements appear to be under sagebrush 12 to 14 inches high with 15 to 25 percent canopy cover (48).

When chicks hatch, they are highly dependent upon insects for food. As they grow in size and mobility, their diet shifts to leaf and flower buds with sagebrush utilized for cover. This dietary trend of taking the most succulent and nutritive parts continues into the summer. A desirable forb composition in brood habitat should be sufficiently diverse to provide a variety of succulent plants throughout the season. By late August or early September broods begin returning to heavier sagebrush stands. This return corresponds with a dietary shift from forbs to sagebrush (37,85,87). Wallestad (87) found: "An interspersion of sagebrush densities from scattered to dense, are utilized by broods throughout the summer. Large tracts of dense sagebrush appear to have relatively little value as sage grouse brood habitat, but are essential winter habitat."

Where large continuous areas of dense sagebrush exist, it may be desirable to break up these areas by burning irregular patterns. This will reduce stand density and improve the spring and early summer habitat since succulent forage production is increased.

5. Raptors and Predators. There can be a favorable effect on raptorial birds and predatory animals which feed on rodents due to removal of protective cover. Rodent populations that subsist on forbs will likely increase due to increased food supply.

F. LIVESTOCK

Vegetative modification is expected to increase grazing capacity of the the sagebrush-grass rangeland through production of a more balanced, diversified, and desirable variety of forage species, and improved accessibility to the forage produced. Potential benefits are:

1. The range should support more livestock.

2. The increased quality and quantity of forage can cause an increase in calf crops through improved physical condition of the brood herd.

3. The average weight of salable livestock should be increased.

4. Livestock losses from poisonous plants may be reduced.

G. ESTHETICS

Increasing variety in the landscape is a positive step towards enhancing scenic quality. Motion in the landscape is a highly significant factor. The visual change from a landscape of continuous sagebrush to a mosaic of sagebrush and grasslands in irregular patterns is a favorable effect. In addition, wild flowers are more conspicuous, and the possibility of wildlife sightings is increased. Both are favorable factors to most people.

H. HUMAN HEALTH

There are no known favorable effects on human health.

I. SOCIAL AND ECONOMIC

Benefits from this program and the resulting additional forage and acres of forage available will be seen in more efficient land use, the stabilization of the present livestock industry, a contribution toward a long-term increase in livestock production to meet the increasing need for more food, improvement of the socioeconomic status through additional individual income, and the stabilization of local, state, and national economy. An atmosphere of security encourages livestock producers to

better plan long-term ranch management operations. Improving range condition and forage production consequently has a profound stabilizing effect on agricultural based communities. The economic value to the local economy, livestock dependent industry, and contribution to the gross national product is unestimated. However, it is generally accepted that there is a significant multiplier for each dollar generated.

IV. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

A. AIR

Prescribed burning causes smoke which becomes part of the gaseous and particulate loading of the atmosphere. Smoke, as defined by the U. S. Department of Health, Education, and Welfare (70), is; "small gas-borne particles resulting from incomplete combustion, consisting predominantly, but not exclusively, of carbon, ash, and other combustible material." Smoke from forest fuels consists primarily of carbon dioxide, water, and particulates which are usually made up of carbon or mineral ash (5).

The U. S. Department of Health, Education, and Welfare and the Clean Air Act of Montana defines air pollution as; "the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as is, or tends to be, injurious to human health or welfare, animal or plant life, or property, or would unreasonably interfere with enjoyment of life or property, or conduct of business." By this definition, almost anything in the air we don't like can be classified as air pollution. The courts, however, have construed "air pollution" to include only contaminants which affect people or property directly or measurably.

There is no evidence that materials resulting from the combustion process of forest fuels are hazardous to human health. The visible cloud of smoke is nearly all water, and its importance is primarily one of visibility. This can be minimized when fire is scheduled and managed with due regard for meteorological conditions that direct

smoke into atmospheric currents which will permit optimum dispersion, diffusion, and dilution (5,29,38). Burns must be accomplished when conditions of fuel moisture, temperature, humidity, and other weather factors are conducive to efficient fires which reduce particulate and gaseous emissions, and permit the convection column to rise rapidly to a relatively high altitude. Stable atmospheric conditions and thermal inversions impede smoke dispersion.

Since this type of burning involves light fuels, individual burns will be intense and of short duration, thereby reducing particulates and unburned by-products that result from fires which burn day and night and span both favorable and unfavorable burning conditions. Usually, most of the particulates are washed from the atmosphere shortly after the burning period.

As a source of air pollution, the proposed burning program is considered as having only a local impact which will dissipate rapidly. All burning operations will conform to the objectives, policies, and operational plans set forth in the Memorandum of Agreement - State of Montana Cooperative Smoke Management Plan developed in January 1973 by the responsible Departments for the State of Montana, all Federal agencies, and the major private landowners, and principles outlined in the Northern Region's Air Quality Guidelines for Prescribed Burning (FSM 5153.13, R-1 Supplement No. 48).

B. SOIL

Protective ground cover is removed through the physical disturbance caused by construction of firelines and consumption by fire. Removal of the protective cover of vegetation and litter leaves the soil bare for wind and water erosion for a short time before a new plant cover becomes established. Erosion removes surface soil which contains the greatest amount of nutrients in the soil profile, so its loss can appreciably decrease soil fertility, offsetting the increase of nutrients released by burning. Raindrop impact can result in soil compaction which reduces

infiltration capacity and permeability, adding to the erosion potential. The amount of erosion depends upon soil characteristics, climate, vegetation, and slope. Recent work by Salih et al (86) indicates that burning of sagebrush produces water repellency in soils. Repellency is reported to be a result of the burning of the sagebrush leaf mulch under the shrub rather than the burning of the live plant material. Maximum repellency was found to occur at soil temperatures between 1400° and 1800°F.

Ehrenreich and Aikman (23) and Kelting (36) report maximum soil temperatures to be much higher on burned areas, which is to be expected since removal of ground cover exposes the soil surface to increased insolation. This is beneficial as plants will begin growing earlier, develop faster, and mature earlier while soil moisture and nutrients are available resulting in rapid establishment of a ground cover. Blaisdell (9) reports that an abundant growth of annuals develops, and as the season progresses, new shoots of rhizomatous grasses and forbs appear with tuft-forming species beginning to stool out. Pechanec et al (53) report erosion was arrested almost completely by the end of the first growing season.

When burning is done outside of the growing season, soil moisture and burning conditions are such that damage to the soil, grass, forbs, and organic matter is kept to the minimum. Early spring or late fall burns with cool, moist soil conditions will alleviate water repellency problems. Aro (3) found no evidence that hot, brush-killing fires sterilize the soil, making it unsuitable for grass establishment. Physical disturbance created by fireline construction will be held to a minimum by programing all possible burns for early spring and using snowbanks as firelines. In the event firelines are needed, they will be the minimum needed for effective control. Machine constructed firelines will be water barred and seeded.

C. WATER

Sagebrush burning can cause short-term accelerated erosion before the soil is stabilized with a vegetative cover, resulting in an increase in turbidity or suspended sediment from overland flow which would affect water quality. The extent will depend upon such factors as soil stability, slope gradient, storm duration and intensity, and size of the area.

Increased sediment may cause short-term reduction in aquatic biota populations. If fisheries are present, siltation may have a temporary adverse effect by reducing suitability of spawning and food producing areas.

There can be a temporary potential for higher peak flows the first year or two which could possibly cause channel scouring and damage to downstream developments.

Impacts can be minimized by conforming the project to level areas and moderate slopes that have soils with a relatively low erosion hazard rating and by leaving buffer strips of undisturbed vegetation and litter where sediment can readily be caught before entering a drainageway. A range that has sufficient understory fuel to provide an adequate spring burn while the soil and mulch are cool and damp has a reasonably good stand of herbaceous plants. If the burn takes place prior to major growth, the stand of herbaceous plants will provide a very rapid development of ground cover that can prevent erosion and excessive soil heating by insolation. Also, project sizes can be limited, thus holding the total water volume increases to a level that can be transported by existing water courses.

D. VEGETATION

Burning can cause a pronounced change in individual species. During the early part of the first growing season, actual damage to vegetation outweighs the benefits. Perennial grasses and forbs are lower in vigor, old clumps are badly broken up, and remaining plants are small and scattered. A study by Mueggler and Blaisdell (46) indicated species harmed were Agropyron spicatum, Antennaria microphylla, Penstemon radicosus, Purshia, and especially Festuca idahoensis and

Forage plants on burned areas will begin growth 2 to 3 weeks earlier in the spring, develop faster, and mature earlier than plants on unburned areas. Because of higher soil temperature and resulting earlier initiation of growth, evaporation and transpiration are greater, causing the soil moisture supply to be depleted more rapidly (23). As a result, forage may dry up a week to 10 days earlier than on unburned range. The early green-up may create big game concentration areas which would be detrimental to recovery of damaged forage plants.

Practically all the evidence in the literature pertains to the effects of summer burns where the fires are particularly hot. Early spring burns are carried out under entirely different circumstances and it is anticipated damage to associated vegetation will be much less severe than on summer burns. The small amount of data available from other sources indicates organisms in cool, moist soil are damaged much less by fire than organisms in a warm, dry soil. There is no evidence that any plant species has been permanently eliminated by sagebrush burning. The greatest impact occurs the first season after treatment, but perennial grass and forb species tend to regain their ecological status within 3 to 5 years except for Festuca idahoensis which may require 10 to 15 years to regain preburn density.

E. WILDLIFE

Burning adversely effects wildlife through damage to habitat. If adjacent habitat is "full" for whatever reason (food, cover, social needs), the removal of a particular species' habitat can reduce the overall population of that species until the treated area again becomes suitable habitat. The planning process attempts to identify potentially adverse

impacts on project areas, and then modify the program to minimize or eliminate the serious ones. There is a possibility some impacts may not be recognized. However, management practices that have improved game range conditions in recent years are: a serious attempt to adjust numbers of livestock and game to the grazing capacity of the range, improved management of livestock and game, adjustments in season of livestock grazing to favor big game winter range, reservation of key game wintering areas for exclusive game use, and artificial rehabilitation of ranges for both livestock and game.

Howard, Fenner, and Childs (30) concluded from their studies that most range fires are not directly destructive to wildlife. They found the principal way such fires adversely affect population densities is by altering the habitat since most vertebrate animals manage to escape the heat of fires by flying or running away, going below ground, hiding in rock outcrops, or seeking islands missed by the fire.

On-the-ground planning is done by the Forest Service with assistance of Montana Fish and Game Department wildlife biologists. The following are possible adverse effects that may occur to various wildlife species:

1. Elk. Evidence from a number of studies shows there is competition between elk and cattle on elk winter range. Range use by big game and livestock need not occur during the same season for competition to exist. Eustance (79) reports grass to be the primary forage on the winter range, shifting to forbs in late May and early June which carries through the summer. Other studies substantiate this evidence (81,83,84). Sagebrush burning can compound existing competition. Project planning

and subsequent management must recognize and allow for such a possibility. Competition on summer range is reported as negligible.

Modifying sagebrush cover can affect calving areas. Known calving areas will not be burned. Leave areas will be planned for elk preferring to calve in sagebrush. Sagebrush areas along ridgetops that would be used during severe winters are removed from the project area.

2. Mule deer. Julander (82) reports, based on his studies in Utah: "Overgrazing and reduced wildfire resulted in an increase in woody browse species on deer winter range. This made possible the buildup of excessive deer numbers - probably greater than could have been possible on virgin range or range in good condition for livestock. Big sagebrush increased more than any other shrub in density and distribution and while not considered highly preferred by deer, it is their 'bread and butter' plant and supplies a greater part of deer winter diet than any other species in Utah." The same hypothesis is very probably true for Montana.

Big sagebrush is one of the best providers of crude protein during the winter, generally maintaining levels of 10 percent or higher. However, Dietz et al (78) report: "Sagebrush probably achieves its highest value as a winter feed when it occurs in a mixture with other palatable species."

Burning on areas within deer winter range where sagebrush is important for food must be considered as an adverse impact, although this impact is partially offset by beneficial factors discussed in Section III. Planning on individual projects will delineate critical habitat areas

so that through consultation with wildlife biologists these areas are eliminated from proposed projects or the project modified to minimize impacts. In addition, there will be unburned islands and stringers that will lessen the impact, and could be beneficial.

Another possible adverse impact is removal of dense sagebrush cover that may serve as fawning or resting areas. Adequate areas are available on adjacent sagebrush stands and in unburned islands and stringers which will minimize this impact.

3. Antelope. Antelope may occasionally use portions of some project areas as summer range. Any adverse effect would be removal of sagebrush used as food and as cover for fawns, but this is not considered serious because of the large acreage of unburned range that remains. Antelope migrate from proposed project areas during the winter.

4. Sage grouse. Sage grouse have not adjusted their life process to fit a pattern of land use which eliminates, or seriously disturbs, large tracts of the sagebrush-grass types on any of their seasonal ranges. They are intimately associated with a sagebrush habitat and are dependent upon restoration and preservation of some sagebrush. Peterson (85) reports: "Range manipulation which would eliminate sagebrush and reduce the abundance and variety of forbs, would lower the ability of this range to support juvenile sage grouse." During the winter months sage grouse are dependent on sagebrush for food and cover. At other seasons sagebrush furnishes a variable amount of the food and the bulk of shelter demands. Adults are heavily dependent on sagebrush due to the specialization of their digestive system.

Burning can adversely affect sage grouse by removal of sagebrush used for food and cover. This could affect population densities for several years within the immediate area of the proposed project. Proposed project areas are believed to be outside of sage grouse winter habitat. However, each project is examined, and wildlife biologists consulted during the planning process. Of particular importance is protection of strutting grounds. When they are found during field examination of proposed projects, the projects will be cancelled or modified to afford necessary protection. Also, there will be sizable acreages of sagebrush remaining adjacent to the burned areas to furnish sage grouse food and cover since control is proposed for carefully selected areas with the highest potential site productivity. Additionally, some of the favorable effects will reduce the impact of adverse effects, particularly for summer habitat.

5. Raptors and Predators. Some adverse effects may occur in the food supply. Populations of pocket gophers will likely increase, but seed eating rodent populations will likely decrease. This effect should be temporary and is not believed to be serious.

6. Nongame Birds. Best (6) reports nongame birds frequently found nesting in sagebrush are the vesper sparrow, Brewer's sparrow, western meadowlark, horned lark, lark bunting, sage thrasher, and short-eared owl. His literature research indicated the sage sparrow, Brewer's sparrow, and sage thrasher are among birds that will suffer through eradication of large acreages of sagebrush.

The Brewer's sparrow nests above the ground in live and dead sagebrush plants which provide cover and structural support. The vesper sparrow's nest is placed on the ground, sometimes under sagebrush providing little cover. Best states that: "Evidence indicates that available cover is a paramount factor in nest site selection by the Brewer's sparrow. The vesper sparrow appears to have less rigid concealment requirements for its nest."

Sagebrush removal could adversely affect Brewer's sparrow, if inherently they must nest above the ground, since the loss of structural support and cover for nests would make the habitat unsuitable within the limited burn area. The impact on the vesper sparrow may not be significant because the growth response of grass would probably provide adequate cover to protect the nest.

F. LIVESTOCK

No adverse effects are known or anticipated.

G. ESTHETICS

Any manipulation of the soil and vegetation creates a visual change which can be disturbing to those familiar with a particular landscape. There is a short period when the project area is freshly disturbed and the activities of man are clearly evident. This is often foreign to an otherwise natural appearing landscape.

Adverse effects are temporary and short term. As soon as grasses and forbs are reestablished, the burned area assumes the appearance of a natural, open grass rangeland.

H. HUMAN HEALTH

There are related hazards to workers on this type of project as there are on nearly all types of outdoor work. Perhaps of most concern is smoke inhalation. However, both Hall (29) and Komareck (38) found no evidence that indicates the combustion products of forest fuels to be hazardous to human health. The exercise of reasonable precautions, as required by the Forest Service Health and Safety Code and project burning plans, will serve to minimize the possibility for injury and impact on human health.

I. SOCIAL AND ECONOMIC

Indirect effects to man are subject to individual preference. There are intangible values associated with a preference for a natural ecosystem, untouched by man, which is considered desirable by some individuals. To many people, fire is judged to be an enemy which is totally destructive. It should be recognized as a natural phenomenon whose presence has been a major component among the various ecological factors in shaping vegetational patterns for thousands of years.

V. ALTERNATIVES TO THE PROPOSED ACTION

A. MECHANICAL CONTROL

This category includes methods developed to physically destroy sagebrush and includes plowing, railing, chaining, rotary choppers, roto-beating, and rolling choppers. All methods have been used at some time with varying degrees of success. Each requires heavy mechanical implements pulled by large tractors, and is limited to moderate slopes without excessive rock.

Railing, chaining, rotary choppers, roto-beating, and rolling choppers, along with equipment required to pull them, require heavy transport equipment to move to project areas, and are subject to mechanical breakdowns. For best results sagebrush stands should be even-aged, old, and brittle. Control of young, flexible plants and seedlings is usually ineffective, and the seedbed created favors sagebrush reinvasion. Herbaceous species are not seriously injured. All methods leave a good litter cover and do not increase the erosion hazard. Treated areas are badly torn up and give a visual appearance of having been farmed for a few years. Costs for these methods of treatment usually are considerably higher and results are less dependable than burning or spraying.

Plowing is seldom an alternative because it requires reseeding and costs become prohibitive. This method is usually employed only on severely depleted ranges when plant composition is such that other treatment methods are not adequate to meet land management objectives. Watershed restoration is frequently a major objective when plowing is used.

Mechanical methods are not considered to be a viable alternative.

B. CHEMICAL CONTROL

In the last 20 years, increased emphasis has been placed on pesticides. Recently, much attention has been directed to the effects of pesticides on the environment, as well as to their development and use. Pesticides are usually classified according to their purpose. Herbicides are one classification and may be defined as any substance or mixture of substances intended to prevent, destroy, repel, mitigate, or inhibit growth of plants.

There is one major group of organic herbicides of particular importance in range resource management because of its selectivity and ability to translocate within plants. This is the phenoxyaliphatic acids group (phenol derivities) which includes 2,4-D, 2,4,5-T, MCPA, micoprop, 2,4-DB, silvex, dichloroprop, MCPB, and 2,4,5-TB. The most commonly used herbicide for sagebrush control is a low volatile ester formulation (isooctyl, butoxyethyl and propylene glycol) of 2,4-D which is applied at the rate of 1-1/2 to 2 pounds (acid equivalent) in 3 gallons of diesel oil as a carrier per acre.

Aerial application by helicopter is the most common method for spraying large areas with variable terrain and ground conditions. The helicopter is maneuverable, flies at a low level at reduced air speed, and allows precise herbicide application to the designated area. Spraying is done under specified conditions for wind and temperature to reduce drift to a minimum, and reduce problems of evaporation, volatilization,

and air turbulence. Application is timed so that sagebrush is still susceptible and nontarget species are least susceptible to reduce the adverse effect to nontarget species.

Grass is not affected by 2,4-D in the concentration used. Production usually increases rapidly and offers strong competition to sagebrush reinvasion. Many forb species are susceptible to 2,4-D and spraying results in a pronounced reduction of these plants in the vegetative community. Recovery usually takes several years. Spraying does not appreciably increase the erosion hazard because there is usually an adequate ground cover of grass under the sagebrush stand.

Esters of 2,4-D are not considered to be persistent. Degradation in soil and vegetation has been found to reach 85 to 90 percent within 13 days following application. Studies show that the amount of 2,4-D used for vegetative type conversion does not impair water quality.

There is a considerable change in the visual appearance of sprayed sagebrush in contrast to nontreated areas. Dead sagebrush plants are visible for a number of years. This visual impact is generally softened within 2 to 3 years by a vigorous stand of grass.

Chemical control is an economic and effective tool. Like other alternatives, it has a place as a range improvement practice. It is considered to be a viable alternative.

C. THERMAL CONTROL[5/]

The Missoula Equipment Development Center at Missoula, Montana, began to investigate the possibility of controlling sagebrush with heat in 1971. This project was undertaken because there is a growing need for sagebrush control methods which have minimum adverse environmental impacts and some initial trial results looked promising.

Working in cooperation with the Northern Forest Fire Laboratory at Missoula, Montana, it was found that sagebrush can be killed if the protoplasm of living cells is raised to about 140°F. Unlike most plants, sagebrush does not have buds, but rather growing points at the tips of its branches.

When the plant breaks dormancy in the spring, the growing points begin to elongate. Tentative information indicates the plant is most susceptible to lethal temperatures from blasts of hot air at this time. Equipment being tested for possible use consists of a propane burner and directional air control vanes to direct and control the hot air blast.

The equipment was tested near Missoula, Montana, in May and August 1971. Although results are not yet conclusive, indications are that sagebrush can be killed with blasts of hot air. More tests are planned with improved equipment to test the concept further and to establish production rates.

This method is not considered a viable alternative at the present time. When perfected, it will be a viable alternative.

5/ED&T 2168, Thermal Brush Control, February 1972.

viable alternative at the present time.

D. BIOLOGICAL CONTROL

There are no known practical methods of biological control, although voles (Microtus spp.) destroy sagebrush by extensive bark removal under certain conditions (47) and at least two insects, Aroga websteri (27) and Trirhabda pilso (56), kill sagebrush by defoliation. The effects of these biological agents have been studied, but no research was found which recommended practical application.

E. INTENSIVE RANGE MANAGEMENT WITHOUT TREATMENT

This alternative consists of changing the range management system from one of continuous use to a system capable of improving vegetation and soil conditions without sagebrush control. This alternative is employed to the extent possible regardless of other treatments applied. It will take a much longer period of time to improve vegetative and soil conditions with management alone. Pechanec et al (54) state that: "Without control of sagebrush only slight improvement in forage yield can be expected on many ranges even after good grazing management has been practiced for 15 to 30 years." Sagebrush control is used to assist recovery of ranges that are in unsatisfactory condition, and in maintaining some vegetative types in a seral stage to provide greater returns to society. A superior system of livestock management will be the prevalent practice employed to maintain the range environment in a desirable condition.

This alternative will be considered viable on a project by project basis.

F. TAKE NO ACTION

The Forest Service is charged by law to manage National Forests and National Grasslands on a sustained yield basis. When deteriorated conditions exist, and practices that are environmentally sound can be employed to hasten recovery, they must be corrected. The alternative of taking no action does not meet the objective of sustained yield management when benefits outweigh the impacts, or for managing the potential of the land in harmony with peoples needs.

VI. RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE OF LONG-TERM PRODUCTIVITY

In essence, there exists a balance between man's use of the land for production of food and fiber and the use of this same land by other elements of the ecosystem. When the selected sites are converted from a sagebrush ecosystem to a grassland ecosystem, the intent is to retain the conversion for a long period of time. It should be recognized that anticipated results may not always occur. The products expected from a sagebrush burning program and the effects are:

1. There will be a long-term improvement in the quantity and quality of forage available for domestic livestock.

2. A variety of plant species form many kinds and variations of habitat. These habitat differences better provide for a larger variety of uses without the uses being in serious conflict with each other. Thus, the forage needs for domestic livestock can be met without serious impairment to wildlife, soils, hydrology, and esthetics.

3. The long-term productivity of the burned areas is improved by development of a more efficient plant community capable of reducing erosion potential from overland flow and high intensity storms, and improving water quality and quantity.

4. There will be a short-term effect on air quality and esthetics.

Intensive grazing management systems are being employed on grazing allotments. These systems are designed to improve or maintain vegetative composition, forage quality and quantity, improve and protect the soil and its hydrologic function, and enhance (where possible) values for other uses. On poor condition ranges, intensive management helps improve conditions, but when high densities of less palatable and highly competitive species such as sagebrush occur, improvement by

exist a balance between man's use of the land for
food and fiber and the use of this same land by other ele-
ments of the ecosystem. When the selected elements are converted from a
natural ecosystem to a grassland ecosystem, the intent is to retain
this condition for a long period of time. It should be recognized that
the desired results may not always occur. The products expected from a
grassland burning program and the effects are:

There will be a long-term improvement in the quantity and quality
of available for domestic livestock.

A variety of plant species form many kinds and variations of
habitat. These habitat differences better provide for a larger variety
of wildlife without the uses being in serious conflict with each other.
Thus the forage needs for domestic livestock can be met without serious
detriment to wildlife, soils, hydrology, and recreation.

The long-term productivity of the burned areas is improved by
establishment of a more efficient plant community capable of reducing
the potential from overland flow and high intensity storms, and
improving water quality and quantity.

There will be a short-term effect on air quality and recreation.

Grazing management systems are being employed on grazing
lands. These systems are designed to improve or maintain vegeta-
tive cover, forage quality and quantity, improve and protect the
soil, hydrologic function, and enhance (where possible) values
for wildlife. On poor condition ranges, intensive management helps
conditions, but often high densities of less palatable and
undesirable species occur. Improvement by

intensive management alone is slow and may preclude the realization of the management objectives for the overall program.

Vegetative modification is an integral part of an overall long-term improvement program.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The effect of burning as used in this program is temporary and transient. There are no foreseen irreversible or irretrievable impacts on the environment. No plant or animal species is expected to be eradicated. All nontarget species that may be affected should eventually return to previous levels unless factors not associated with the program intervene.

VIII. CONSULTATION WITH OTHERS

A. ANALYSIS OF COMMENTS RECEIVED ON THE DRAFT STATEMENT

Comments received represented a cross-section of individuals, groups, and State and Federal agencies. The majority of the responses favored the program. Many of the specific comments were substantive and have been incorporated into the Final Statement.

Predicted environmental impacts and effects described in the Draft and Final Statements are based on the firm premise that protective measures listed in this Statement will be followed to the best of our ability. We carefully considered comments suggesting changes in the protective measures, or that brought out adverse effects that could happen if the protective measures were in error.

We have not been able to consider those comments that were too general, or were based on practices or environmental conditions different than those described for this program.

Important comments that need to be considered fall into the following general areas of concern:

1. The program is livestock use oriented. Several replies commented that the project primarily benefits livestock use.

Comment: We recognize, and accept the criticism, that the primary objective of the sagebrush burning program is to improve the range resource for use by domestic livestock. The requisite is to evaluate the program to determine if the objective can be achieved without impairment of the productivity of the land while at the same time producing high-level sustained yields of the several products and services of the

National Forest. We believe the predicted environmental impacts and effects of the program are evaluated fairly in the Final Statement which has been expanded in response to many of the comments received. As with all things, we recognize that anticipated results may not always occur, and that data must be updated continually.

2. The effect of burning and fireline construction on soils. Comments expressed concern about the erosion hazard on soils bared by burning and fireline construction.

Comment: Concern for soil erosion is valid and has been recognized in the text as a potential detrimental effect of the program. Section IV, item B, has been expanded in recognition of these concerns. Soil scientists and hydrologists assigned to the Forests carrying on the program are involved in the planning and selection of project areas so that erosion hazard problems are recognized. Early spring burning will result in rapid establishment of protective cover and the need for a minimum amount of fireline.

3. Should big sagebrush be controlled by direct manipulation as a range improvement practice? This question was stated by several respondents.

Comment: We interpret this to refer to the successional status of big sagebrush communities. It is difficult to classify, without question, sites that were originally sagebrush dominated or originally grass dominated. The literature presents competent evidence the sagebrush ecosystem has expanded, largely as a result of disturbance caused by human activities in the past. A quotation from Benchmarks: A Statement

of Concepts and Positions of the Society for Range Management seems appropriate: "Man's economic and social needs will always influence the management and use of range resources. Thus, natural systems may be modified or manipulated for economic and social purposes, but only within the elastic limits of natural balance if such purposes are to be met on a lasting basis." Our intent is to carry out projects only on the more productive sites, and only after all impacts and consequences have been carefully considered.

4. The effect of burning on hydrological aspects. Comment was received expressing concern about hydrological functions following burning. Comment: Concern regarding water yields, water quality and quantity, and soil moisture conditions are valid. The text attempted to present an unbiased appraisal of potential detrimental effects as well as beneficial effects of the program based upon review of available literature. We concur that anticipated results may not always occur, however; the protective measures established in the text are specifically directed toward minimizing the possibility of adverse effects.

5. The purpose of cost-benefit analysis. There were comments regarding use of a cost-benefit analysis to justify a program. Comment: The economic analysis is not developed as a justification for a program. It is a requirement in the guidelines for preparation of environmental statements. The best available cost figures were used. Because the analysis is for a total program and not an individual project, it is necessary to use a weighted average cost. We concur that assumptions and conclusions are used, however, these were based

on critical analysis of available data. Also, we recognize that results from the program are not as "cut and dried" as presented, but a common denominator was necessary to develop the analysis.

6. Size of individual projects. Concern was expressed in regard to individual projects where more than 300 acres may be burned in one block.

Comment: The expressed concern was not specifically directed at any environmental factor or resource impact, but is considered to have validity. We wish to emphasize that projects will not be geometric in design. Also, unburned islands and stringers are anticipated, particularly on the larger projects. The size of individual projects will be critically analyzed in the Environmental Analysis Report prepared on the Forest for each project.

7. Air Quality and State of Montana's "Recommended Guidelines for Open Burning." The Air Quality Bureau, Montana State Department of Health and Environmental Sciences, is in general agreement with the proposed program although it usually discourages prescribed burning for range management purposes. Their response states: "A permit will be required prior to this burning and burning can only be performed during periods of good smoke dispersion. Burning should occur only between 10:00 a.m. and 4:00 p.m."

Comment: We agree burning is to be performed during periods of good smoke dispersion and have discussed this in Section IV, item A, of the Statement. We do not feel we can comply with the requirement of burning only between 10 a.m. and 4 p.m. on many of the projects. To comply

would mean igniting the prescribed burns during the most hazardous burning period in the day when temperatures are rising, humidity falling, and wind conditions the most unpredictable. Such a restriction will greatly complicate control procedures and definitely increases the possibility of the fire escaping the prescribed area.

We believe the use of the word "should" in the letter recognizes the problems associated with prescribed burning and furnishes the latitude necessary to carry out the burning program in accordance with proper fire management procedures.

8. Effect of burning in regard to wildlife relationships. Several comments received expressed a general concern in regard to wildlife relationships and for attention to wildlife needs.

Comment: Concern in regard to wildlife relationships and for attention to wildlife needs is valid and has been recognized as a potential detrimental effect of the program. Beneficial effects are also recognized. Section III, item E, and Section IV, item E, have been expanded in recognition of these concerns following review of additional literature to more completely relate impacts, beneficial and adverse, to the program.

9. Inadequate treatment of the impacts of a sagebrush control program on wildlife and a bias toward livestock grazing. Response from the Montana Fish and Game Department was strongly unfavorable and critical of the proposed program.

Comment: Comments were primarily general in nature and offered very little constructive criticism. Sentences and portions of sentences

were consistently quoted out of context. The comments were analyzed and are discussed individually as follows:

(1) We agree burning is an adverse impact on the wildlife habitat and had so stated on page 45. The statement is more positive in the final draft. Nowhere in the Statement do we advocate removal of small patches of sagebrush.

(2 & 3) These quotes are from the opening paragraph of the Statement in which the intent is to set the stage for the text which follows. The points raised are discussed in considerable detail under several headings in the text (I-B, I-D, I-E, III, and IV).

(4 - 9) These comments pertain mainly to the Ecological System and center on the successional status of sagebrush communities.

We feel that the discussion on page 3 is an accurate presentation of facts regarding the sagebrush-grass type and the successional status of sagebrush communities. We agree that sagebrush is a part of the natural plant community and have so stated, but can find no research which record dense stands to be natural. The wording "eventually force the elimination" was not properly used and has been modified. As the text now reads it is substantiated by the literature cited.

There was no intent to downplay the importance of Artemisia tridentata. We simply stated facts as found by researchers (Cook, Dietz, Julander, Nagy, Smith). The use and importance was discussed in Sections III-E and IV-E. The presence of growth inhibitors is reported by Wilkie and Reid (73) and other researchers cited in their literature. The reference of Schlatterer and Tisdale (87) cited in the comment states: "Apparently

sagebrush leaf litter may be inhibitory to germination of all three species.", (the three species referred to being Stipa thurberiana, Sitanion hystrix, and Agropyron spicatum) and concluded: "The results here presented suggest that germination and early growth of perennial grasses may be inhibited by sagebrush and moss litter." They went on to say: "The level of inhibitory effects obtained with Artemisia tridentata and Tortula litter is such that the actual effectiveness of such materials under field conditions is very doubtful."

We accept the criticism that "dense" was not defined in the Draft Statement, nor is it defined in the Final Statement. However, the guidelines stated in FSH 2209.23 R1, Nonstructural Range Improvement Handbook, are included in Section I-D of the Final Draft.

(10 - 12) We believe the text as written is a statement of facts as recognized by research. This includes the literature cited as well as other literature which was reviewed.

(14) Schalt (61) made a rather detailed evaluation of the overall chemical control program in 1965. Individual projects are monitored for 2 to 5 years to evaluate the treatment. Meaningful followup evaluation has many implications. What we consider as meaningful obviously is not interpreted the same by the Department. We solicit the Department's assistance in meaningful followup evaluation.

(15 - 16) We accept the comment and believe we recognize there are many demands other than livestock grazing placed on Federal rangelands. That was the point being made. Also, that these demands must be

correlated between land use efficiency and the socioeconomic status of people. Supporting evidence as well as adverse impacts are discussed in Sections III and IV of the Statement.

(17) This was discussed under item A-4, above.

(18) We accept the criticism of this comment to the extent the text as written did not properly convey the intended meaning. The text has been changed through substitution of the word "management" for "grazing" which clarifies the intent of the text.

(19, 22, 24) The quotation from the Statement has taken phrases out of context of three sentences in a paragraph. We feel the complete paragraph as written is applicable.

Nowhere in the Statement have we advocated removal of small islands of sagebrush. We recognize that if adjacent habitat is "full," for whatever reason (food, cover, social needs), the removal of a particular species habitat will reduce the overall population of that species until the area again becomes suitable habitat.

We can make no "guarantee" that burning will produce a mosaic of sagebrush. It should be recognized that anticipated results may not always occur.

(21, 23) We accept the comment that sage grouse are "entirely" dependent upon sagebrush when applied to cover their winter range. Research by Klebenow and Grey (37), Peterson (85), and Wallestad (88) report juvenile sage grouse and adults heavily utilize the most succulent and nutritive parts of leaf and flower buds from mid to late summer.

On page 46 we noted that sagebrush was used by deer for resting areas. We have added the comment in regard to antelope fawns.

(25, 26) We feel these comments are covered under A-1 of this section.

B. FEDERAL, STATE, AND LOCAL AGENCIES AND INDIVIDUALS TO WHOM THE FINAL STATEMENT WILL BE SENT

1. Federal Agencies

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Denver, Colorado 80203

Assistant Secretary - Program Policy
Attention: Office of Environmental Project Review
Department of the Interior
Washington, D.C. 20240 (18 copies)

State Conservationist
Soil Conservation Service
Federal Building
Bozeman, Montana 59715

Director
Bureau of Land Management
Federal Building
316 North 26th Street
Billings, Montana 59101

2. State Agencies

State of Montana
Department of Intergovernmental Relations
Planning and Economic Development Division
4124 Ninth Avenue
Helena, Montana 59601 (6 copies)

3. Elected Officials

Honorable Mike Mansfield
United States Senate
Washington, D.C. 20510

Honorable Lee Metcalf
United States Senate
Washington, D.C. 20510

Honorable Richard Shoup
House of Representatives
Washington, D.C. 20515

Honorable John Melcher
House of Representatives
Washington, D.C. 20515

4. Organizations, Groups, Universities, and Individuals

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APPENDIX I. LITERATURE CITED

LITERATURE CITED

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APPENDIX II. LETTERS RECEIVED ON DRAFT STATEMENT

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

3200

n reply refer to:
EP ER-73/239

FEB 21 1973

Dear Mr. Yurich:

This is in reference to your letter of February 5, 1973, requesting the Department of the Interior's review and comments on a draft environmental statement for the control of big sagebrush by burning in the State of Montana.

This is to inform you that the Department will have comments on the draft statement but will be unable to reply by the date requested since the statements were not received until February 20. Our comments should be available about the end of March.

Sincerely yours,

Bruce Blanchard, Director
Environmental Project Review

Mr. Steve Yurich
Regional Forester
Forest Service
Department of Agriculture
Federal Building
Missoula, Montana 59801

Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

FEB 14 1973

BUREAU OF LAND MANAGEMENT

Mr. Yurich:

In response to your letter of February 5, [illegible] requesting the Department of the Interior's view and comments on a draft environmental statement for the control of big sagebrush by burning in the State of Montana.

This is to inform you that the Department will have comments on the draft statement but will be unable to reply by the date requested since the statements are not received until February 20. Our comments will be available about the end of March.

Sincerely yours,

Jack O. [illegible]
Deputy Director
Environmental Project Review

Mr. Steve Yurich
Regional Forester
Forest Service
Department of Agriculture
Federal Building
Missoula, Montana 59801

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INT Bozeman

REPLY TO: 1940 Environmental Statements February 20, 1973

SUBJECT: Burning for Control of Big Sagebrush

TO: Steve Yurich, Regional Forester
R-1, Missoula, Montana

The environmental impact statement on sagebrush burning sent to me for review appears reasonably objective and comprehensive. If one agrees to the premise that we need to increase usable forage production on such areas dominated by big sagebrush, then this certainly can be done by removing the sagebrush. And, as pointed out in the impact statement, fire and herbicides are the only feasible tools for quickly doing this. I personally believe burning is superior to spraying in such cases, if for no other reason than fire is a natural phenomenon under which this vegetation has evolved. Consequently, infrequent burning is not likely to have unexpected, longlasting adverse effects.

One major omission in the discussion of adverse impacts concerns the physical disturbance created by construction of fire lines for controlling fire spread. If done by blading, a double line with a burn-out in between, a sizable area in total will be scraped to mineral soil with consequent detriment to the perennial vegetation, aesthetics, as well as possibly permitting invasion of undesirable annuals. If adequate fire lines are not built, and occasionally even when they are, fire escape can cause sizable losses to both range and adjacent forested areas.

My other comments are rather minor and concern a matter of emphasis and implications which I feel erroneous. In paragraph 1 on page 2, the statement on "imbalance of plant species" and on establishment of a "more balanced, diversified, and desirable variety of plant species" suggests incorrect conclusions and a fuzzy lack of distinction between numbers of different species and relative amounts of existing species. No doubt it would be correct to state that many areas have an undesirable balance between forage and nonforage species. I think it incorrect to imply that dense (?) sagebrush cover alone reflects an "imbalance" in nature. Also, burning will not change the numbers of different species, except perhaps for the occurrence of a few annuals not usually obvious otherwise; burning only changes the relative amounts of species already there.

The page 2, paragraph 2, reference to Cooper's study implies his conclusion that sagebrush in excess of 10% reflects deterioration also applies to southwestern Montana mountain rangeland. Cooper's study was restricted to a 10-inch precipitation area on flat, alluvial terraces at about 4,000

ft. elevation in Wyoming--a situation in many respects considerably different than the areas involved in Region 1. We really don't know how much sagebrush reflects deterioration in this area. I suspect the amount is highly variable and dependent on local environment.

I seriously doubt that sagebrush competition "can force the elimination of herbaceous plants" as stated in paragraph 2 on page 3. It can reduce the amount of herbaceous species, but I have yet to observe where it can "eliminate" any species. Usually abusive grazing is responsible for reductions in vigor of herbaceous plants, which in turn allows sagebrush to invade. Once there, the sagebrush can dominate, but if the area is not grazed, and if it is truly a grassland climax, then sagebrush will have difficulty reproducing and eventually will die out over a long period of time.

I believe the statements referring to water yield improvement on page 11 (item 2), pages 30, 31, and on soil erosion on page 58 (item 3) are much too strong for what is actually known. Such conclusions related to sagebrush lands, particularly those with a substantial herbaceous understory, are largely conjectural and are not verified by hard evidence.

I also question the validity of the statement on page 17, paragraph 1, that a 38% increase in ground cover for watershed protection and wildlife would result from burning. This erroneously assumes that sagebrush has absolutely no value for providing ground cover and habitat for wildlife. I bet that total vegetal mass (including sagebrush) is greater on the unburned than on burned areas!

I appreciate the opportunity to review this statement. As a whole, I think it is well done.

Walter F. Mueggler

WALTER F. MUEGGLER
Principal Plant Ecologist

Montana State University
College of Agriculture
Agricultural Experiment Station
Bozeman, Montana 59715
Tel. 406-587-3121
mal and Range Sciences Department

February 20, 1973

Mr. Steve Yurich
Regional Forester
U.S. Forest Service
Missoula, MT
59801

Dear Mr. Yurich:

Thank you for the opportunity to review the Draft Environmental Statement for the Northern Region's program of controlling big sagebrush by burning.

Overall, the statement seems to cover the significant points, with one major exception. This exception relates to the wildlife relationships. I believe it would have been advisable to review in more detail the information available on big game food habits and relate this to possible impacts on wildlife, both beneficial and adverse.

There are a number of minor points (that might lead to some major problems in response to this impact statement) on which I would like to comment:

1. Page 2, B "...with a concurrent decrease in vegetative productivity". This statement is not defensible so far as I am able to determine. Total vegetational mass production can be expected to be higher on a range with a mixture of grasses, sedges, forbs and shrubs than if one of these components is removed. Sagebrush control is largely a trade-off practice wherein a major use of moisture, light, etc. is changed from sagebrush to the grass-sedge-forb complex. This should read "...with a concurrent decrease in the productivity of other components of the vegetation, particularly grass".

2. Page 3. "Sagebrush ....can eventually force the elimination of herbaceous plants from the understory.....". I do not know of any evidence that sagebrush will force out other species. My interim report (1972) on the effects of sagebrush spraying on the Beaverhead Forest clearly show that the herbaceous understory is plentiful enough under sagebrush to provide a ground cover. Most of these sagebrush stands have been established long enough so that the sagebrush would have done the eliminating long ago if this process in fact took place. The evidence is clear that mismanagement reduces the herbaceous understory. A stand of sagebrush may be sufficiently competitive to prevent significant restoration of the herbaceous component.

3. Page 9. It is proposed to burn 5,400 acres. How does this acreage compare with the total acreage on which sagebrush exists on the three National Forests? How does the acreage being burned in each management unit compare with the total acreage of sagebrush range in the management unit and with the unit total acreage?

4. Page 12, Paragraph 2. I strongly object to this kind of wording. Sagebrush management is part of range management. This sentence is correct only when it says, "Sagebrush control concurrent with improved livestock grazing management can bring about these benefits in a shorter period of time than improved livestock grazing management alone." Everything done on a range is range management, including grazing animal (domestic and wild) management, plant control, water development, etc., etc. Read the definition of range management in the Society of Range Management "Benchworks".

5. Page 15. "....perennial forage production...." should read ".....perennial forage production for livestock....."; "..... increase in grazing capacity....." should be ".....increase in livestock grazing capacity.....". Throughout the statement there is a good deal of fuzziness about the intended meaning of words such as forage, production, palatable, grazing, etc. If "livestock forage" or "livestock grazing" are meant, the adjectives should be used. To me, the term "forage" applies to all vegetation used by ungulates, wild or domestic. When one writes about increasing or decreasing "forage production", it should be stated whether this applies to livestock, wild ungulates, or both. As stated in item 4 above, range management is not simply the management of domestic stock on ranges.

6. Page 29. The use of the term "basal density" is incorrect. "Density" now is generally accepted as number of plants per unit area. The term "basal cover" is correct in this case.

7. Pages 41-42. See attached article on water repellency in soils.

8. Pages 42-43. It should be pointed out that a range that has sufficient understory fuel to provide an adequate spring burn obviously has at least a reasonably good stand of herbaceous plants. If the burn takes place prior to major growth, the stand of herbaceous plants will very likely provide a very rapid development of ground cover that can prevent erosion and excessive soil heating by insolation. Fall burning, on the other hand, often leaves the ground bare over winter and subject to erosion hazards.

9. Pages 43-44. The references all have to do with the effects of summer burns where the fires are particularly hot. Early spring burns are done in entirely different environmental circumstances and damage to associated vegetation is likely to be much less than on summer burns. Unfortunately, there is no direct evidence on this influence in sagebrush burning, but the small amount of data available from other sources indicates that organisms in cool, moist soil are much less damaged by fire than organisms in a

warm, dry soil. Both soil conditions and fire conditions are involved.

A major issue, of course, is whether big sagebrush should or should not be reduced by direct manipulations. This impact statement addresses the general question moderately well. But this does not answer the specific question of whether or not sagebrush should be controlled in each of the burns proposed. There is no information as to the amount of sagebrush occurring in each project area, how the expected responses relate to the averages used in the economic analyses, and how recreation, wildlife and watershed factors are related to each project. The decisions, in my mind, must be project by project decisions. I think the statement ought to have attached to it the project information which serves as the bases for specific decisions. I may agree thoroughly on control in one project and disagree as thoroughly in another project. This statement does not provide any vehicle for such judgements and it is these judgements that are really crucial.

Sincerely yours,

Gene F. Payne
Professor
Range Sciences

GFP/ww

Enc.

cc: Carl Wambolt
Peter Jackson

Cooperative Extension Service
MONTANA STATE UNIVERSITY, U.S. DEPARTMENT OF AGRICULTURE, AND MONTANA COUNTIES COOPERATING
MONTANA STATE UNIVERSITY
BOZEMAN, MONTANA 59715

February 27, 1973

Mr. Steve Yurich
Regional Forester
U.S. Forest Service, USDA
Federal Building
Missoula, MT 59801

Dear Mr. Yurich:

I appreciate the opportunity to review your agency's Draft Environmental Statement concerning control of big sagebrush by burning in the Northern Region.

Because I have read Dr. Gene F. Payne's comments regarding the Draft Statement I will be somewhat briefer than otherwise would have been the case. Dr. Payne has expressed some very important concerns which I share.

The very apparent lack of sufficient information regarding wildlife relationships should be corrected with the addition of pertinent facts.

I would think it very proper for the opinions of the Montana Fish and Game Department to be included as a part of the Statement since it is that Department's role to be primarily concerned with the well-being of wildlife. I strongly suggest that the Fish and Game Department's opinions would show a much greater concern over the possibilities that control of sagebrush would have adverse effects on wildlife through their special expertise and prior first-hand experience.

I am basically opposed to the idea of a Federal Agency using a cost-return study to justify a program that has questionable effects on the environment. If the project is of a nature that requires an environmental impact statement, this means that it should have already been recognized that monetary weights are not justification for the required action. As is the case with most cost-return ratios, the one in the study does not account for possible negative economic effects of sagebrush control such as loss of wildlife and subsequent decline of associated recreational enterprises and sales.

It appears that interpretation of the literature reviewed in many instances was not as objective as it could have been. Many of the publications reviewed simply do not pertain directly to the situation being addressed in the Northern Region's plans for

big sagebrush control. I believe greater care should be taken so that the literature is not used in a misleading manner.

Under your description of action it is stated "... burning as a means of modifying the continuity of the sagebrush ecosystem to improve the range resource...." This should read "... to improve grazing for domestic livestock...," because the range resource includes many other values of which none can be automatically categorized in this manner in reference to the stated action.

When reading the Statement it is apparent that a definite bias in support of sagebrush control was projected by the author(s). The real basic question of importance is, should big sagebrush be controlled at all on public lands? Past criticism of herbicide control of the same species has resulted chiefly because of the loss of the sage brush and some associated species of both plants and animals and not to a very great extent because of the use of herbicides.

I hope that my comments will be considered as constructive in nature as that is the intent in furnishing them to you.

Sincerely,

Carl L. Wambolt

Carl L. Wambolt
Range Specialist

CLW:hp
cc: Torlief S. Aasheim
Gene F. Payne

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION VIII
FEDERAL OFFICE BUILDING
19TH AND STOUT STREETS
DENVER, COLORADO 80202

March 1, 1973

Re: Draft Environmental Impact Statement
Burning for Control of Big Sagebrush

Your Ref: 1940 (NR)

Mr. Steve Yurich
Regional Forester
USDA Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurich:

We have reviewed the above referenced statement as submitted to our Department and have no adverse comments regarding areas of responsibility under our programs.

Thank you for submitting the statement for our review.

Sincerely,

John R. Garfield, Deputy

Rulon R. Garfield
Regional Director

cc:
J. McCoy/Wash.D.C./DHEW

University of Montana
Missoula, Montana 59801
(406) 243-0211

SCHOOL OF FORESTRY

March 1, 1973

Mr. Steve Yurick
Regional Forester, Northern Region
U. S. Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurick:

I do appreciate the opportunity to review the report: Environmental Statement, Burning for Control of Big Sagebrush.

There are some statements which may need modification and it may be desirable to add others. On page nine the paragraph starting with line four, I would add a sentence stating that in Western Montana a sizeable acreage represents sagebrush migration into natural grassland. This is particularly true on some well developed soils of medium texture.

An appropriate place should contain a statement that fire has been a natural environmental factor in the sagebrush ecosystem and has had but limited effect on the ecosystem.

It might strengthen the report from a pollution standpoint as well as disturbance created by fire to point out that (page 9) the 1800 acres per year may not involve more than a maximum of 700 acres in one million? acres in any one year. However, I would question the advisability of burning more than 300 acres in one block.

On page 36, the reference to Klebenow doesn't bring out the use of seeds of species like the butter weeds. If the butterweeds or similar plants increase after burning, this would be important.

In general I find the report an adequate statement of the problem of the use of fire in the improvement of sagebrush range land where its abundance restricts the use of land or reduces the efficiency in the land to produce forage. Certainly, if the necessary attention is given to wildlife needs, no serious violation of the biological stability should take place.

Sincerely yours,

Melvin S. Morris

Melvin S. Morris
Prof. Emeritus Range Management

MSM:dj

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

STATE OFFICE
316 NORTH 26TH STREET
BILLINGS, MONTANA 59101

IN REPLY REFER TO:
911:1792

F.S. R-1
RECEIVED
MAR 2 1973
REGIONAL FORESTER

MAR - 1 1973

Mr. Steve Yurich
Regional Forester
Forest Service
Federal Building
Missoula, Montana 59801

Dear Steve:

Our office has reviewed the draft environmental impact statement prepared by your agency concerning the control of big sagebrush by burning. Our comments have been forwarded to our Washington office to facilitate a consolidated Departmental response which will be sent to you in the near future.

We appreciated the receipt of the impact statement and the opportunity to comment thereon.

Sincerely,

Harold C Lynch

for Edwin Zaidlicz
State Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

316 North 26th Street
Billings, Montana 59101

IN REPLY REFER TO:

MAY - 1 1973

59801

Thank you for your recent comments on the draft environmental impact statement for [illegible]. Your agency's concerns will be considered in preparing the final statement. Our comments have been forwarded to our Washington Office to facilitate a coordinated Departmental response which will be sent to you in the near future.

We appreciate the receipt of the letter advising us of the assignment to [illegible].

Sincerely,

Edwin Zaffis
State Director

University of Montana
Missoula, Montana 59801
(406) 243-0211

SCHOOL OF FORESTRY

March 2, 1973

Mr. Steve Yurich, Regional Forester
U.S. Department of Agriculture, Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurich:

Dean Robert Wambach ask me to review one of the draft environmental statements for the Northern Regions program of controlling big sagebrush by burning.

In general I find it acceptable. Since the ultimate impact of fires will be determined by a large number of integrated factors, both known and unknown, controls at the local level will be most important.

I suspect that 700 acres may be somewhat large for a single project, especially if blocked out in the general configuration of a square.

Perhaps a bit of clarification is needed for bitterbrush response to fire. Statements on pages 35 and 44 are not in agreement as one indicates increased production from burning and the other harm to the plant. Since bitterbrush is presumed to be an important browse species it seems desirable to know the extent of sprouting in the plants on the control area.

Sincerely,

Lee E. Eddleman

Lee E. Eddleman
Assoc Professor of
Range Management

LEE:dj

Lee G. Vadinea
Assoc Professor of
Range Management

WESTERN MONTANA COLLEGE
DILLON, MONTANA 59725

March 2, 1973

Mr. Steve Yurich
Regional Forester
U. S. Department of Agriculture
Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurich:

I have received the Draft Environmental Statement for the Northern Region's program of controlling big sagebrush burning. The study seems to have been well prepared and I have no specific criticisms to offer. When making a choice of control methods for sagebrush, I would choose burning over the 2,4-D spray because of the greater damage which the latter causes to the forbs. Burning is a natural process which the plant and animal organisms have evolved with and adapted to. Long-term effects of chemical control are still unknown.

Sincerely yours,

Daniel G. Block
Associate Professor of Biology

jc

cc: Rex Hartgraves
Dr. James Short

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

P. O. Box 970, Bozeman, Montana 59715

March 5, 1973

Steve Yurich
Regional Forester, Region 1
U.S.D.A. Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurich:

Re: 1940 Environmental Statements

The draft environmental impact statement "Burning for Control of Big Sagebrush" that was addressed to the State Conservationist, Soil Conservation Service, Bozeman, Montana, on February 5, 1973, has been reviewed by our staff.

The draft recognizes fire as an ecological factor that influences and shapes plant community development. The frequency of uncontrolled wildfires prior to white man's arrival helped balance naturally the sagebrush component on sites originally dominated by grasses.

Because fire bares the soil to wind and water erosion for a period before plant cover becomes established, soils on each site should be inventoried and classified for erodibility hazard. Chemical control which leaves more litter and vegetation for soil protection should be strongly considered an alternative on the more erodible sites to reduce erosion and sedimentation.

Intensive management grazing systems must be planned and implemented concurrently with a brush control program to avoid reinvasion of sagebrush and to insure project goals of improved soil cover, increased infiltration of precipitation, improved watershed conditions, and increased forage production.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

A. B. Linford
State Conservationist

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

THOMAS L. JUDGE, GOVERNOR
GARY WICKS, DIRECTOR

MEMBERS OF THE BOARD
JOSEPH W. SABOL, CHAIRMAN
OWEN E. SOWERWINE
DR. WILSON F. CLARK
DEAN HANSON
RILEY OSTBY

449-3647
SAM W. MITCHELL BUILDING
HELENA, MONTANA 59601

CONSERVATION DISTRICTS DIVISION

F. S.
R. F.

March 6, 1973

Mr. Steve Yurich, Regional Forester
U. S. Forest Service
Federal Building
Missoula, Montana 59801

Dear Steve:

In reply to your request for comments on your draft Environmental Statement Burning for Control of Big Sagebrush, I have just completed reading the statement and a copy of the letter from Gene Payne, MSU, on the subject.

A person could comment in great detail in what I would consider a nitpicking atmosphere. But I would like to go on record stating that this statement is well done and covers the situation in a complete manner. You should be complimented for the fine job.

I would like to reiterate my feelings as I have before both written and spoken that I have great confidence in people who are technically trained and have been assigned the responsibility of managing our lands and until such time that it is proven without doubt that they are mismanaging, I feel that it is the responsibility of these people to carry forward in the manner that they have been trained.

This statement is a good example of the high quality of production that comes from your department. I feel that when these statements are completed, we will be able to move ahead with the management of the forest lands particularly proper control of sage brush which will benefit all people.

Sincerely,

Peter V. Jackson, Chief
Grass Conservation Bureau
Conservation Districts Division

STATE OF MONTANA
DEPARTMENT OF INTERGOVERNMENTAL RELATIONS

PLANNING AND ECONOMIC DEVELOPMENT DIVISION
MAIL TO CAPITOL STATION. HELENA. MT 59601

THOMAS L. JUDGE
GOVERNOR

PED OFFICES AT:
ADMINISTRATION, RESEARCH
1424 NINTH AVE.
406/449-2400
COMMUNITY DEVELOPMENT
1424 NINTH AVE.
406/449-3757
ECONOMIC DEVELOPMENT, INFORMATION SYSTEMS
1716 NINTH AVE.
406/449-2402

March 8, 1973

Mr. Steve Yurich
Regional Forester
Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurich:

Enclosed please find comments on the Draft Environmental Impact Statement for the Control of Big Sagebrush by Burning.

The Fish & Game Department had trouble in getting their comments back from their field men and will air mail them upon receipt.

Thank you for the opportunity to review and comment on this statement.

Sincerely,

Lloyd F. Meyer

Lloyd F. Meyer, Assistant Chief
Community Development Bureau

LFM/cmp

Enc: Comments from Dept. of State Lands; Dept. of Health; Environmental Quality Council

P.S. The Dept. of Natural Resources had no comments.

PLANNING AND ECONOMIC DEVELOPMENT DIVISION
DEPT. OF CONSERVATION AND ENERGY
FED OFFICES BL
ADMINISTRATIVE
RESEARCH
1424 NINTH AVE
816 449 44

[illegible]

[illegible]

[illegible]

DEPARTMENT OF STATE LANDS

STATE CAPITOL HELENA 59601 (406) 449-20

Memorandum: March 5, 1973

To: Lloyd F. Meyer
Dept. of Intergovernmental Relations

From: Bob Duncan
Department of State Lands

Re: Comments on U.S.F.S. draft environmental impact statement on Burning for Control of Big Sagebrush.

I personally believe that there are benefits to be obtained from buring sagebrush in some cases without unacceptable adverse environmental impacts. The U.S.F.S. statement reads as if someone else who also believes as I do, has written a document to defend that position, rather than to set down what is known about the practice with equal weight to positive and negative studies and conjectures. A few examples:

Cost-Benefit: The cost of the practice is assumed to be an average of $3.18/Ac. Following the computation of the average cost on page 14, there is a detailed cost-benefit and investment "justification" using this average cost. However, the figures used to produce the average contained numerous projects where the cost exceeded $7.00 per acre. Granted that with such a wide range of costs it is very difficult to project the costs of the proposed burns. However, if the actual cost is $7.00 or $8.00 per acre on the proposed projects then the cost-benefit to the Federal Government acting as the proprietary manager of the National Forests would not show the positive ratio listed in the statement. The net effect would be a subsidy to grazing users. There is nothing wrong with subsidy to segments of the economy which in general will benefit the entire society and there are non-quantified possible benefits which have not been entered into the calculations; but the statement does not address itself to a discussion of these aspects - it attempts to prove a point. Impact statements should serve a wider purpose of agency self examination rather than justification.

Memorandum: March 2, 1973

To: Lloyd F. Meyer

From: Bob Duncan

Hydrologic Aspects: Following are some quotations from the statement on hydrologic aspects:

P. 11. "It is expected...that water yields will be improved through substitution of grasses and forbs which utilize less water than shrubby vegetation."

P. 26 "These [temporary microclimatic changes] can lead to changes in edaphic factors such as....increased soil moisture."

P. 30 "Evidence from several studies indicates sagebrush removal increases soil moisture."

"Conversely, Hutchinson found significantly more snow accumulation in sagebrush areas than on comparable grass covered areas which could result in earlier peak flows and incomplete soil moisture recharge."

P. 41 "Raindrops impact can result in soil compaction [on new burns] which reduces infiltration capacity and premeability adding to erosion potential. The amount of erosion depends upon soil, characteristics, climate vegetation and slope."

P. 45 "Because of higher soil temperature [on burns] and resulting earlier initiation of growth, evaporation and transpiration are greater, causing the soil moisture supply to be depleted more rapidly."

P. 58 "The long-term productivity of burned areas is improved by development of a more efficient plant community capable of reducing erosion potential from overland flow and high intensity storms, and improving water quality and quantity.

This last quotation is the summary conclusion on the long-term effects of burning sagebrush. It is difficult to understand how such a firm conclusion can be reached in light of the conflicting results in Hutchinson's study on page 30. If there are conflicting research results, then the statement should address itself to this problem and make it clear that anticipated results may not always occur. A U.S.F.S. publication[1] which reviewed the literature on sagebrush removal effects contains the following summary conclusions:

Memorandum: March 2, 1973

To: Lloyd F. Meyer

From: Bob Duncan

"Previous studies of the effect of sagebrush control on features of the soil moisture regime provide conflicting results.", p. 35.

"The effects of sagebrush on snow accumulation and disappearance are complex; their resultant is indeterminate.", p. 35.

This literature review examined many of the studies used by the Forest Service in their impact statement to "prove" that the removal of sagebrush has a beneficial hydrologic effect, but the conclusions are more cautious. Again, I personally believe that hydrology is improved by removal of some sagebrush in some cases, but the literature review shows that one cannot make broad assumptions about the removal of sagebrush. The U.S.F.S. impact statement makes broad assumptions and conclusions which may or may not be true, but are not justified in any document which has the purpose to make an honest examination of current knowledge.

[1] Literature Review for Problem Analysis - Hydrology and Management of Sagebrush Lands, Project FS-RM-1603 (Rev.); Laramie, Wyoming, Rocky Mountain Forest and Range Experiment Station.

State of Montana

State Department of Health
and Environmental Sciences
HELENA, MONTANA 59601

JOHN S. ANDERSON, M.D.
[redacted]
Director

March 6, 1973

STATE OF MONTANA/RECEIVED
MAR 7 1973
INTERGOVERNMENTAL RELATIONS
PLANNING/ECONOMIC DEVELOPMENT

Lloyd F. Meyer, Assistant Chief
Community Development Bureau
Department of Intergovernmental Relations
Planning and Economic Development Division
Capitol Station
Helena, Montana 59601

Re: Comments on draft environmental impact statement entitled "Burning for Control of Big Sagebrush.

Dear Mr. Meyer:

The Air Quality Bureau generally discourages prescribed burning for range management purposes, but in the case of big sagebrush it appears this is the only available alternative. The "Recommended Guidelines for Open Burning" developed in the last two years by the Air Quality Bureau states that although burning of sagebrush is considered essential, the plants must be torn loose from the ground, wind rowed, dried and piled before burning is permitted. However, when this practice is used for range management purposes it appears the damage from heavy equipment, etc. would outweigh any adverse effects from prescribed burning.

A permit will be required prior to this burning and burning can only be performed during periods of good smoke dispersion. Burning should occur only between 10:00 a.m. and/or p.m. ← should read 4:00 p.m. DRH

Again, this agency is responsible for maintaining clean air in the state and we would encourage the development of alternate forms of range management. However, in this case burning appears to be warrented.

Sincerely,

Don Holtz

Donald R. Holtz, Chief
Air Quality Bureau

DRH:dmg

2-27-73

ENVIRONMENTAL QUALITY COUNCIL
CAPITOL STATION
HELENA

TO: Lloyd Meyer
Dept. IGR
Capitol Station
Helena

STATE OF MONTANA/RECEIVED
FEB 2 1973
INTERGOVERNMENTAL RELATIONS
PLANNING/ECONOMIC DEVELOPMENT

Lloyd,

Would suggest you forward this to Ben Wake so that he and his staff would have the opportunity for review & input. We have no comments aside from the above suggestion.

Loren

A - 27 - 73

STATE OF MONTANA

DEPARTMENT OF FISH AND GAME

Helena, Montana 59601

March 12, 1973

Mr. Steve Yurich, Regional Forester
Northern Region, U. S. Forest Service
Federal Building
Missoula, Montana 59801

Dear Mr. Yurich:

We have reviewed the Draft Environmental Statement on "Burning For Control of Big Sagebrush". We appreciate this opportunity to comment on this proposed experimental treatment which could have a serious short and long term impact on wildlife habitat in southwestern Montana.

Regarding this Statement itself, it has an unfortunate similarity to the one reviewed last year on Herbicide Control of Sagebrush. In our opinion, the 1973 Draft Statement on Burning again lacks objectivity in trying to fairly assess all values on the public rangeland -- and is extremely biased towards the single use of livestock grazing. If you will closely read your Draft Statement you will see that this single theme is dogmatically pursued throughout, even to the point where it is inappropriate to the format of the Environmental Statement itself.

We have opposed herbicide control of sagebrush because it primarily has been a vegetation-conversion method to benefit a single industry and at the expense of the resource we are charged with maintaining and perpetuating. We cannot support public-funded practices that result in large scale removal of a plant as valuable to wildlife as is big sagebrush. We question the wisdom of "range improvement practices" that ultimately result in increased grazing pressure on already depleted range with no assurance of improving overall vegetation conditions. We also share the concern of those range management experts who question whether *adequate grazing control* can be assured after these "action programs" are initiated.

We agree that sagebrush burning is still in the experimental stage as indicated in your EIS of 1972. For this reason, we strongly urge *if it is your decision* to destroy sagebrush on public lands with fire, that it be done

[illegible]

[illegible]

[illegible]

on a small scale and in such a manner that it will not disrupt the overall integrity of wildlife habitat on total units of treatment. Serious efforts would be necessary when applying fire to leave specific areas of vegetation necessary to maintain the diversity of plant cover so important to wildlife habitat. Such experiments and additional research should be a *minimum requirement* before embarking upon the operational size treatments described in this Statement.

We respect your position as the decision-maker in this process and also hope that you consider such charges of your Agency (which this Draft Statement did not) as the Multiple Use-Sustained Yield Act -- which in essence defines the management of resources in the combination which best meets the needs of the American people; not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output!

We will support range management alternatives that are capable of improving and maintaining overall vegetation and soil conditions. We cannot support a program (or Environmental Impact Statement) that does not sincerely consider all uses and public benefits.

We hope that you will receive these remarks realizing that our responsibility is to the wildlife resource and to all people in Montana now and in the future who will enjoy and benefit from it.

Specific remarks as to the text of the Draft Statement are attached.

Sincerely yours,

Wes Woodgerd

WESLEY R. WOODGERD, Director

WRW/rm

cc: Russell E. Train
T. C. Byerly
Sheldon Meyers
Ivan Dotson
John Green
Edwin Zaidlicz
Mike Mansfield
Lee Metcalf
Frank Church
Eldon Smith
Ted Schwinden
Fletcher Newby
Don Aldrich

COMMENTS REGARDING DRAFT ENVIRONMENTAL STATEMENT ON BURNING FOR CONTROL OF BIG SAGEBRUSH.

1. Page ii -- It is stated "There is an impact on wildlife habitat due to removal of food and cover, and a change in edge effect." This would be an *adverse* impact on wildlife habitat. The removal of small patches of sagebrush will reduce the edge; continuous grassland has less edge and less value to wildlife.

2. Page 2 -- "When properly applied, burning . . . enhances. . .wildlife . . . ." This is strictly conjecture; no evidence is presented to substantiate that claim.

3. Page 2 -- The first two sentences indicate an imbalance of plant species exist in the sagebrush-grass ecosystem as a consequence of dense sagebrush. This evaluation is from the viewpoint of how this situation influences the area's potential for livestock grazing. It is *not* an imbalance for many other uses or values.

4. Page 2 -- "Sagebrush has become the dominant plant on millions of acres of sagebrush-grass rangeland in the Western United States with a concurrent decrease in vegetative productivity." It should be pointed out that a *decrease* in vegetative productivity occurred *before* and was the reason sagebrush could increase.

5. Page 2 -- The term "dense" is used many times in this statement but is never defined -- how much is dense? On page 2, sagebrush with 25 percent or more crown cover is indicated to be dominant. Is this the same as dense? If so, will 25 percent crown cover be used as the minimum criteria to qualify an area for burning control? If not, how much crown cover will be the minimum standard for control? Specific areas to be treated were not listed and so it was not possible to offer specific comments on control areas. How much "dense" sagebrush is left after 15 years of intensive chemical control?

6. Page 2 -- "Cooper concluded that relative amounts of big sagebrush in excess of 10 percent of the total ground cover are indicative of deteriorating range conditions." Page 3 -- "Dense stands of sagebrush on extensive areas of rangeland today are largely the result of disturbance caused by past human activities. . . ." Many dense stands of sagebrush occur naturally and are not indicative of range deterioration. Some sites have the potential for supporting dense sagebrush unrelated to any of man's disturbances.

7. Page 3 -- The statement indicates several times that sagebrush is the cause of or contributes to a deteriorated range condition. "Sagebrush . . . can eventually force the elimination of herbaceous plants from the understory" is a statement that cannot be substantiated by scientific study. In fact, there is evidence that the opposite can be the case.

8. Page 4 -- The discussion of *Artemesia tridentata* appears carefully selective to downplay the importance of this particular shrub. Shrubs that are "intermediate in palatability" can be of critical importance to big game animals during severe winters. Sage grouse are entirely dependent on sagebrush. The statement on volatile oils is misleading when used in this limited context.

9. Pages 5 and 32 -- "The presence of a growth inhibitor in the leaves of . . . these species of sagebrush (ARTR, ARCA, ARTR) could influence vegetative distribution patterns since they are capable of reducing germination percentages of at least some grasses." There is no basis given for this statement. Inhibition of germination percentages does not necessarily prevent the actual establishment of grass seedlings, as not all germinated seeds become established anyway. Schlatterer and Tisdale (1969)* found that 4 weeks after germination, growth of grass seedlings was actually stimulated by the presence of litter material. Most work on inhibitor effects of sagebrush litter evidently has been done under greenhouse conditions. Schlatterer concluded, "The level of inhibitory effects obtained with *ARTR* and *Tortula* litter is such that the actual effectiveness of such materials under field conditions is very doubtful."

10. Page 6 -- ". . . improvement of certain wildlife habitat . . . being somewhat controversial . . ." is "glossing over" the truth. In Montana sagebrush control is *detrimental* to many species of wildlife, especially sage grouse and antelope.

11. Page 6 -- "Research recognizes that benefits include additional forage, more acres of forage available, increased pounds of livestock products, improved watershed conditions and water yields, and improvement of certain wildlife habitat--this latter being somewhat controversial (1, 2, 9,9,10,19,25,31,44,53,54)." Research does not recognize this -- only a selected search or slanted interpretation of the literature could produce that conclusion.

12. Page 6 -- "By virtue of its wide distribution and ecological amplitude, big sagebrush has a significant influence on rangeland." Page 31 -- "Grasses and forbs cannot compete successfully with established sagebrush plants for sunlight and soil moisture." On many depleted ranges the only forb and grass vegetation are "islands" under and around sagebrush plants with bare ground between these islands. Schlatterer (1968)* found that grass seedlings *survived better* under sagebrush plants in spite of inhibitor effect and reduced drought resistance.

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*Schlatterer, E. F. and E. W. Tisdale. 1969. Effects of litter of *Artemisia*, Chrysothamnus, and Tortula on germination and growth of three perennial grasses. Ecology 50(5):869-873.

*Schlatterer, E. F. 1968. Establishment and survival of three native grasses under natural and artificial conditions. Ph. D. Thesis. University of Idaho, Moscow. 105 pp.

13. Page 8 -- "Project proposals are reviewed with Montana Fish and Game Department wildlife biologists." It should be mentioned that these joint "reviews" seldom result in a mutually agreeable or palatable proposal. Joint reviews cannot be considered an endorsement of the program by this Department.

14. Page 8 -- "Evaluation does not end with the report, but continues over an extended period of several years." This needs some elaboration as to what will be checked and when. We have seen little evidence of any meaningful follow-up evaluation on the many thousands of acres previously chemically controlled.

15. Page 10 -- Two statements on this page are indicative of single-use orientation and a lack of objectivity. "It is generally recognized there are demands placed on Federal rangelands other than for grazing by domestic livestock." "These (other)uses are not seriously competitive with livestock grazing, and should in no way detract from the importance of these rangelands to the livestock industry and society." Are there not many other demands for Federal rangelands which are becoming increasingly important to many other segments of the American public? As a multiple use agency, is not the United States Forest Service charged to seriously consider them in this statement of proposed action?

16. Page 11 -- "Some wildlife will benefit. . . ." This statement lacks supporting evidence.

17. Pages 12-24 -- The portion of this statement dealing with economics only considers the benefits of one alternative. Social and economic values of wildlife have been ignored, as have the values of many other benefits. What are the values of benefits lost because of sagebrush burning? What are the costs and benefits of the other alternatives, including that of "Take no action"? The National Environmental Policy Act of 1969 directs all agencies of the Federal Government to identify and develop methods and procedures which will insure that presently unquantified environmental amenities and values are given appropriate consideration in decision making along with economic and technical considerations. No attempt to fulfill this directive was noted in this Environmental Statement.

18. Page 24 -- When discussing subsequent livestock management, it is stated -- "This formula is designed to provide quality livestock grazing in each specific forest-range ecosystem". Management practices which provide high "quality" livestock grazing often produce low "quality" values for many other uses.

19. Page 33 -- "The edge effect . . . it logically follows . . . can possibly benefit wildlife." The value of the edge effect is overstated and misapplied in this overall statement. Edge effect is of little value unless both types are needed by wildlife. If, in the creation of edge by burning, certain cover or other necessities are destroyed, the edge will be of little value. The removal of small islands of sagebrush will actually reduce the amount of edge. Will the Forest Service consider designing and conducting burns so as to *guarantee* a mosaic of sagebrush and not create "large blocks" (25-700 acres) devoid of sagebrush?

20. Pages 34, 46, and 47 -- Lack of objectivity in the Statement has resulted in a misleading use of the format. For example (Section III, Favorable Environmental Effects), discussing favorable effects of burning sagebrush on mule deer, half of the discussion questions the value of sagebrush rather than listing favorable effects. Conversely, on pages 46 and 47 (mule deer and sage grouse) in Section IV on "Adverse Environmental Effects Which Cannot Be Avoided", the merits of burning are again repeated.

21. Page 35 -- Sage grouse are "entirely" dependant upon sagebrush, not "largely" dependant.

22. Page 36 -- ". . . it may be desirable to break up these areas by burning irregular patterns." Breaking up areas of dense, continuous sagebrush can destroy the cover value in critical areas for sage grouse and other wildlife.

23. Page 46 -- Sagebrush is also important to deer as cover; extensive burning could be detrimental in this respect. The removal of cover for antelope fawns is a distinct adverse effect.

24. Page 47 -- "It is anticipated that burning will produce a mosaic . . . ." Depending upon the characteristics of unburned "islands" of sage left, they may no longer be of value as cover. "It is anticipated" is no guarantee for wildlife values -- if no "islands" of sagebrush or mosaics are created or maintained, the adverse effect would be severe.

25. Page 56 -- "The alternative of taking no action does not meet the objective of sustained yield management when benefits outweigh the impacts, or for managing the potential of the land in harmony with peoples needs " is another statement indicative of consideration for only one value or objective -- livestock grazing. What about other obligations and responsibilities as charged under the Multiple Use Act? What about managing the land for its "potential" for producing wildlife and recreation? Because land has a potential for livestock grazing is not a mandate for a multiple use agency to employ extreme measures to achieve that potential, especially when it lowers the potential for other uses? "In harmony with people's needs" infers a knowledge of what people's needs and desires are; presentation of that knowledge was not included in this Statement.

26. Page 58 -- "Thus the forage needs for domestic livestock can be met without serious impairment to wildlife, soils, hydrology, and esthetics." "Without serious impairment" suggests some impairment, and in the case of wildlife, little is known of the effects of burning sagebrush; impairment could be very serious particularly if sagebrush is destroyed in units as large as proposed.

C O P Y

2501 So. Dakota
Butte, Mont. 59701
Feb. 27, 1973

ref. Burning Sagebrush and Little Creatures

Forest Supervisor

Sir:

We had just begun to believe that (the men in the business of Conservation at least) had learned their lesson about the balance of nature, destroying habitat and killing wildlife with sprays.

Obviously we have been too gullible. Pesticides were bad enough but now you plan to appropriate habitat and maybe cook the little animals, as well! Why not put a small limit on livestock land?

To burn large areas is about the cruelest thing we've yet heard. It isn't enough to dispossess animals, now you must burn their forage, cover and no doubt many creatures such as: mice, gophers, rabbits and their young, and many others that could panic and be trapped. Probably deer and antelope does will be run to death (carrying their young) or abort--

Or do you plan to trap all and reestablish? A vain hope we fear.

How can you even consider such cruelty; have we become so greedy we can't spare some wildlife or must it all go for Man and his blasted Cows or for farmland?

We've seen some astounding conservation practices used by the Fish and Game but this is the worst. Conservation (to save, to conserve) is this just another word to be tossed about (without meaning)?

Please, do not do this thing. Also you could have allowed a little time for complaints.

We object.

/S/Mrs. E. Hatton, C. Hatton
and William Pettersen

C O P Y

C O P Y

R.R. Box 157
Whitehall, Montana 59759
Feb. 28, 1973

Regional Forester
Steve Yurich
Federal Building
Missoula, Mont.

Dear Steve:

I was so glad to see the article on sagebrush burning. I wondered when it would come. I have been doing this in a small way but I have sold my place now.

I found there are times when the snow is off on my smaller pieces. I catch a time when we have a light snow, it goes off the sage and it burns.

It is a shame the amount of land lost to sage on my place since I have been unable to do what I should. I would say sage has taken over one third of the range in our area. This includes Forest land as well as adjoining land.

So if I can be of any help to you, feel free to call on me.

Best of luck to you.

Yours truly,

/S/Eugene J. Clark

C O P Y

C O P Y

C O P Y

501 Walnut
Anaconda, Mont. 59711
Feb. 28, 1973

Regional Forester Steve Yurich
Federal Building
Missoula, Montana

Dear Sir:

I am concerned as to your plans for destroying sagebrush over a large area of Montana, which includes Deerlodge National Forest.

For several reasons I feel this issue surely should be reconsidered. First we hear so very much (and rightly so) about many species of animals (including small rodents) are in danger of becoming extinct. The prairie dog is a good example. If I understand the plans their normal locations and way of life would surely be disrupted, which could add to this danger.

My husband was Chairman of the Deer Lodge Cemetary Board (here in Anaconda) for 12 years. One of his greatest worries and problems was a shrub type of weed, yellow in color, that was taking over when other vegetation was destroyed. In a few years it had moved over a large territory over much of the state and is almost impossible to control. He only found one weed killer that was effective which had to be used in an extremely strong mixture, which was also very expensive and dangerous to use, if great caution was not used.

He could not learn the name of this plant (if there is one) but we have seen it far from here in most directions. Was a very heavy growth in the Big Timber area, also around part of the Whitehall area. I fear this weed will surely move in where the sagebrush is destroyed, too. Apparently animals do not eat it.

Now for what you may consider a very selfish reason on my part, but a very serious problem to many others that are allergic (as I am) to sagebrush. The fumes in the smoke that would travel for as far as 40 miles (so my allergist told me) would be a serious health threat.

Have you ever been in any part of montana where the landbank has been in effect for many years? I have and the last time I was there, it was still being used in the Willow Creek benchland. While plans have been considered to put more land under cultivation. One of the big arguments why we need to build more dams in Montana. Could this same thing happen to the sagebrush area too? I wonder.

Thank you for reading my reasons and giving me the opportunity to express my opinions. This is my land too and I am concerned about many detrimental things that are taking place.

Very sincerely,

/S/Mrs. C. A. S. Davison

C O P Y

2 March

Route 1
Manhattan, MT 59741

Dear Reader

you would have recieved a more readable response to your request for popular opinion on the Sagebrush burning program you propose had I the time. Since the deadline for my response is monday the 5th I feel I have only today (Fri) and tomarrow to do it. I don't really feel I can make an educated response in that short of time. But here goes.

First of all how many deer and other game animals use this sage brush for winter range or at some other time? How will their populations be effected and how will the watershed cover be insured a fast and effective growth? Is there danger of erosion?

Curiously, Bob Ottersberg

Dear Sir!

Comment regarding Sagebrush Burning:

For a hundred years the cattlemen have vigorously fought against anything or anybody who opposed the methods they use to extend their vast domain in the state of Montana.

Witness the driving of Indians from their homeland to the reservations, the burning of poor hardworking homesteaders' shacks, the lawless vigilante-type hanging of rustlers, some no doubt guilty, but also many innocent parties. The land grabbing, millions of acres acquired illegally, extra-legally or by any means available, on which, incidentally they pay little or no taxes.

Now, with the aid of corrupt and dishonest public officials they have hundreds of thousands acres of public land fenced and set aside for the private use of their ever-hungry cattle, while the ordinary tax-burdened citizen who actually owns these properties is barred from any type of activity, recreational or otherwise. They have posted no trespassing signs on miles of rivers and streams and threaten to shoot the very people who stocked these streams with fish from money derived by their licenses and fees. With their inhumane poisons they have practically eliminated every form of wildlife that walks, flies, swims or crawls.

I was born and raised in Montana and know that not many years ago there was quite an abundance of wildlife in this area. We had rabbits, squirrels, coyotes, eagles, sage hen, grouse, prairie chicken, etc. It is indeed a rare sight today to see any of these creatures. In this aforementioned environment the cattlemen and sheepmen seemed to prosper very well.

Today these people, in their desire for more $100 hats, $150 shoes, fleets of Cadillacs, and $100,000 homes want to destroy the few acres of natural habitat left in the state by burning the sagebrush and eventually turning more of this beautiful state into a vast wasteland.

I think we must now stop this destruction of our land. Probably the American people will have to eat fewer $2.00 a pound beefsteaks but in the end they will have a much better environment for themselves and their children to enjoy for many years to come.

The people of this state have to rely on the people in public offices who are being paid to protect the interests of all the citizens and not the selfish, greedy few.

Joseph Sedley

A VERY CONCERNED MONTANA NATIVE!

P.S. I am enclosing an article which I clipped from the December, 1972 issue of the Readers Digest. I am hoping you will have time to read it as I think it is very informative.